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Forest
Service

**Intermountain
Region**

Ogden, Utah

Characteristics Of Old-Growth Forests In The Intermountain Region

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ROCKY MTN. FOREST & RANGE
EXPERIMENT STATION

United States Department of Agriculture | Forest Service | Intermountain Region | 324 25th Street Ogden, UT 84401

Reply to: 2410

Date: MAY 19 1993

Dear Reader:

Enclosed is a report on the "Characteristics of Old-Growth Forests in the Intermountain Region." This report culminates an extensive effort by a number of people, working as teams, within the Intermountain Region, the Intermountain Research Station, various local academic institutions, other agencies, and selected members of the public to define and describe the physical, ecological elements that characterize old-growth forests within the Intermountain Region.

Old-growth forests can mean many different things to people. To some, they have spiritual values inherent in respect for enduring life forms. To others, old-growth forests take on a more scientific perspective in reference to their role as preferred habitat for specific species of animals and birds, and as contributors to the development and maintenance of biological diversity. And to others, old-growth represents the onset of physiological terminus, or maturity, of the measurable life span of given forested cover types. In this latter situation, some view older, decadent forest conditions as an acceptable opportunity to utilize the dead, dying, and mature trees for human consumption.

Frequently, these important considerations of old-growth include a number of strong personal perceptions that often are very difficult if not impossible to physically quantify, inventory, and map with any mutually acceptable degree of concurrence or consistency. For that reason, this effort concentrated on identifying the specific measurable physical tree and stand attributes that under reasonable levels of predictability normally would be expected to characterize the late seral and early climax stages of successional development of forest cover types within the Intermountain Region.

This was a pioneering effort to define old-growth forests from an ecological perspective; no current inventory of the acres of old-growth forest land as defined by these definitions currently exists for forest cover types in the Intermountain Region. Further, these definitions and descriptions may be somewhat different than the definitions and descriptions of "old-growth" included in current Forest Plans. As a result, they may lead to somewhat different old-growth management direction and decisions.

The 1989 Action Plan prepared by the National Old-Growth Task Force directed that inventories and maps of old-growth by these definitions will be completed in accord with standard forest (timber) inventory schedules, which are closely linked to scheduled Forest Plan revision dates. Efforts will be made to develop a preliminary estimate of the amounts and locations of old-growth forest land available for use in individual Forest Plan revisions.

Further, efforts will be made during the revision process to evaluate old-growth forests as more than independent and isolated ecosystems. More importantly, an ecological evaluation will be conducted as part of a more comprehensive forest landscape analysis process to determine patterns for old-growth areas. This analysis process will involve an Interdisciplinary Team and public participation effort to look at a broad spectrum of uses and values that are dependant on the ecological attributes of old-growth forests, forest cover types in the earlier structural stages of successional development, and their relationship to other compositional features of the landscape.

We hope this report will be helpful in developing an understanding of the physical characteristics of ecological old-growth forests. We encourage you to work closely with local National Forest personnel during scheduled Forest Plan revision efforts in developing a concensus understanding of the role or position that old-growth forests play in using an ecological approach to management of the National Forest System Lands. Please feel free to contact your local National Forest or Ranger District office if you have any questions regarding this report.

GRAY F. REYNOLDS
Regional Forester

Enclosure

CHARACTERISTICS OF OLD-GROWTH FORESTS

IN THE INTERMOUNTAIN REGION

COMPILED BY

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REGIONAL GENETICIST

APRIL 1993

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PREFACE

The term "old-growth" is used by many people, from various publics to personnel within various agencies and companies. When the term is applied to forests it seems to mean many things to many people. There are inconsistencies in its use or application. In an effort to provide continuity and utility to the term, and reduce misunderstandings and misrepresentation, this "old-growth" definition and description program was undertaken. However, the program is more complex than simply putting labels on Forest cover types.

This definition and description document is but a part of a process to deal with a variety of topics concerning old-growth. This first part of the process defines and describes the ecological attributes of old-growth "what is it?" Cover types are identified by specific quantified tree and stand attributes that characterize the late successional stages in the dynamic process of stand development and aging. This document describes standard attributes of old-growth that can be identified and measured for given forest cover types at the onset of late seral and climax stages. This standard, which is a Minimum Qualification Criteria, can be used as a comparison to measure and categorize specific stand situations. It is important to standardize inventory techniques to describe old-growth attributes.

Location and mapping of old-growth stands will precede answers to the next two critical questions - "how much do we have" and "where is it?" Eventually the number of acres by cover type of old-growth will be determined or be determinable by several techniques. These determinations must be accomplished before we can adequately address an old-growth situation. When the critical question "what are the values associated with it?" is addressed, provision of the needs for specific uses/users, that are dependent on old-growth, will be developed. These needs may include wildlife or fisheries habitat, biological diversity, recreation, visual quality, long-term soil productivity, water quality, and high quality industrial wood supplies.

Following the identification of "what is it," "how much do we have," "where is it," and "what are the associated values," comes a question that may possibly be the hardest to answer. "How much do we need?" Determination may involve identifying old-growth obligate species of wildlife, defining population viabilities, and defining the genetic interaction needed to maintain a population's vitality. In other cases it may require identifying how much area is required for visual quality, the sensory feel, or other recreational needs. In some cases it may mean determining how much should be left just for themselves and not just for other reasons. There are also numerous other needs.

Last, and possibly most controversial, is the question "how do we manage to meet the needs and the values?" These management decisions and prescriptions will need to be addressed through site-specific activities or projects and in National the Forest Land and Resource Management Plans. The term "management" will have to be determined, especially what is allowed or accepted. In most cases there will be management for old-growth in a dynamic ecosystem. Management decisions and prescriptions should address long-term needs from both temporal and spatial standpoints at the landscape levels. The management of landscapes will require efficient Geographic Information System (GIS) capabilities.

The process of determining old-growth attributes is starting and adjustments will occur as it proceeds. This should be expected. Old-growth ecosystems are dynamic and improved or increased information is being obtained about those systems each year.

Six sub-Region Teams developed definitions and descriptions for both primary and secondary cover types depending on location and extent of the cover type in the area (see Appendix C). Close coordination between teams occurred; they actively exchanged information, descriptions, and concerns for special situations. Each team reviewed and commented on the definitions and descriptions developed by the other teams. A lack of consensus on the elements of each cover type, where more than one team had interest in the cover type, reinforced the fact that there are variations in the amplitude of these ecological situations. That resulted in variations in the description for the cover type.

A broad cross-section of people participated in the development of the descriptions and definitions. Forest Service personnel, university professors, State wildlife officials and privately employed professionals from a variety of backgrounds were involved. Public comments and input were sought by each sub-Region team. The methods used and input received varied considerably. In each case, public interests were sought in a variety of ways. Informed and interested publics were generally sought out. In some areas very little public interest was generated; in other areas public interest remains, especially about how the process will proceed.

OLD-GROWTH DEFINITIONS

Introduction

Old-growth forests are currently under scrutiny by the public and land managers. Controversy resulting from different perspectives concerning old-growth forests focuses on what it is and how much of it remains. A major controversy centers primarily on the coastal forests of the Pacific northwest and California, although interest has been expressed in various places in the Intermountain Region. To answer questions about old-growth on the National Forests, a National Old-Growth Task Group was formed to develop old-growth definitions. Before an assessment could be made of how much old-growth forest remains, there needed to be a common acceptable definition of old-growth. The National Task Group and all Forest Service Regions have determined that an ecological definition of old-growth is the most appropriate. Refinements of an ecological definition, based on individual management needs or public concerns for values, such as wildlife habitat specific to certain species, esthetics, or other values of biological and social significance can be made later.

The objectives established by the Chief of the Forest Service for each Region were to establish ecological definitions of old-growth for each forest cover type currently described in Society of American Foresters (SAF) *Cover Types of the United States and Canada* 1/. Definitions would utilize the best available information from teams of qualified people. Each Forest Service Region was to establish a draft set of definitions to deal with forest cover types within its boundaries.

Following the development of the Regions' draft guideline definitions, by June 1991, Inter-Regional coordination of definition across commonly administered cover types would occur. This was to account for specific variations within cover types found in each Region's draft definitions, realizing that some major cover types cover a great range of situations. The varying situations are often ecologically significant, therefore, descriptions were expected to vary.

This document includes descriptions of the ecological characteristics of old-growth for most of the SAF cover types found within the Intermountain Region, which covers Utah, Nevada, the eastern slope of the Sierra's in California, Idaho south of the Salmon River and Wyoming west of the Absaroka and Wind River Mountain ranges. These are draft descriptions. For that reason, and as indicated above, definitions may change. The changes will principally be the result of field-testing or verification, additional data, or inter-regional coordination.

1/ Eyre, F.H. editor 1980 Cover Types of the United states and Canada Society American' Forester, Washington D.C. pp 80-141.

Applications

The Intermountain Region, as directed by the Chief, established a list of SAF Forest Cover Types for which old-growth definitions would be developed. Because of the extent of the National Forests of the Intermountain Region at least 13 cover types potentially needed old-growth definitions. The large number of cover types occur because the Region encompasses a variety of mountain ranges with a wide array of climatic and geological situations. To cope with that array, the Region was divided in geographical areas. This allowed the maximum use of local ecological field expertise, research scientists and ecologists from the Intermountain Research Station, and universities. The areas tended to fit groups of different cover types, or encompass cover types or separate areas with substantive differences in ecological character. The area names tend to define the general area and included southern Utah, northern Utah, southeast Idaho/western Wyoming, southwest Idaho, Nevada, and Toiyabe-Sierra (see Appendix C). A definition team was formed for the cover types in each area.

Each team operated separately in the initial development of definitions, except the Toiyabe-Sierra (see Definition Teams). The Toiyabe-Sierra team coordinated with the California Region teams that were developing similar cover type definitions. The Toiyabe-Sierra team indicated that California Region cover types covered a wide variety of ecological situations which were suitable for the Sierra-Nevada portion of the Intermountain Region. The Bridgeport and Carson Ranger Districts portion of the Toiyabe National Forest shall utilize the California Regions cover type descriptions for old-growth definitions. Those applicable SAF cover types are; California mixed subalpine (Code 256), white fir (211), lodgepole pine (Sierra variety 218), Sierra Nevada mixed conifer (243), Jeffrey pine (247), and red fir (207).

Two additional cover types, Cottonwood-willow (235), and Rocky Mountain Juniper (220), occupy a very limited extent of the National Forest land area and were not described. The breadth of the interior ponderosa pine cover type resulted in a division of that cover type.

The teams developed old-growth definitions based on the Forest Service "generic" ecological definition: "old-growth forests are ecosystems distinguished by old trees and related structural attributes; old-growth encompasses the later stages of stand development that typically differ from earlier stages in a variety of characteristics which may include tree size, accumulations of large dead woody material, number of canopy layers, species composition, and ecosystem function." The primary objective was to focus on ecological and vegetation attributes characterizing old-growth. Each team was specifically instructed at the definition development stage to not be concerned with tree or stand attributes considered necessary to meet the needs of specific values, uses, or sensual perceptions of older forest stands. Vital considerations in developing those attributes were: (1) ability to be inventoried using standard methods of field inventory including satellite imagery and (2) ability to be consistently determined by anyone in the field.

Limitations

The teams developed a set of minimum qualification criteria that in combination define old-growth. The criteria are considered to be screening criteria and in many cases more than one old-growth vegetation condition can be described because of major variations in ecological circumstances. Variations in those circumstances also make some descriptions specific to a certain geographic area. Those limitations are identified for each cover type. In some instances differences occur between administrative boundaries because of large separations between forested lands. In all cases the limits of vegetative and geographic application are determined by cover type. This is because each predominant species has a different optimal response zone that causes a lack of commonality between and among species in cover types between geographic areas.

Old-growth definitions apply to each cover type described in the *Cover Types of the United States and Canada* 1/. The book describes species composition and geographical situations for each cover type. Unfortunately, in some geographic areas cover types will change as plurality of stocking changes. Therefore, the descriptions should be considered to be dynamic. Definitions are only applicable to the described cover type in stands that meet the species composition and locational criteria. Additional specific limitations are found within the cover type description.

Definitions were developed from observations and data obtained from stands with no apparent substantive human intervention or apparent drastic natural disturbance. Stands with minimal tree removal, firewood cutting, or other minor human-induced intervention of a limited scope were included in the old-growth assessment.

Stand Structure and Disturbance - General

Forests are often simplistically described as passing through six or more vegetation structural succession stages as they develop through time. Natural events and human-induced activities directly influence the rate of movement through these successional stages. Fires, wind, hailstorms, and insect outbreaks are but some of the natural influences. Prescribed fire, grazing, timber harvesting, fire suppression, recreational use are some of the human-induced activities influencing successional development.

Old-growth is considered to start at the sixth stage of vegetation structural succession and is further defined as early and late old-growth. That sixth stage is used by the definition team as the general "model" to describe old-growth stand attributes (see appendix A). Occasionally, predictable disturbances combined with the physiological characteristics of some tree species within specific cover types may preclude reaching the sixth or "model stage. In these cover types the fifth stage is the oldest predominating stand with a moderate amount of stability before rejuvenation; it is considered old-growth.

1/ Eyre, F.H. editor 1980 Cover Types of the United States and Canada Society American Foresters, Washington D.C. 143 pages.

In the sixth stage of succession, stand conditions would be expected to include both seral and climax tree species. Compositionally in fire-dependent species and short-lived intolerant species with only single species composition, forests are dominated by seral species. Shade tolerant, long-lived species tend to make up the old-growth systems, with long large fire occurrence frequency and minimal natural disturbances.

Fire historically has dominated as a natural disturbance mechanism in the Rocky Mountain forests. Up to the late 1800's it was the primary influence on successional development. Frequent low intensity fires moved through the lower elevation forested stands removing down-woody residues, seedlings, other small plants, and shrubs. Fire-resistant trees with thick bark such as ponderosa pine and Douglas-fir survived the frequent fires, maintaining many stands in an open, park-like condition featuring large mature trees with small pockets of seedlings and saplings, occasionally occurring with understory grasses, forbs, or brush.

Forested stands at higher elevations have short cool summers with frequent high-intensity short duration lightning storms. These green moist forests burn in-frequently. When they burn the result is a patchy incomplete burn pattern. However, these forests have been plagued by insect epidemics which were followed by broad-scale high intensity large fires. Stands were often completely destroyed or a range of forest mosaics was created, depending on weather, fuel loading, and other influences.

The ecological relationships of fire are contained in three fire ecology publications by the Intermountain Research Station, General Technical Reports INT-218 covers central Idaho, INT-290 eastern Idaho and western Wyoming, and INT-287 the forests in Utah. The composition, structure, and function of the ecological landscape continues to dramatically be influenced by fire and the human intervention through its control.

With fire suppression activities and livestock grazing beginning in the early 1900's, the Forests of the Intermountain Region began to develop a complex character with a wider variety of tree species and more shrubs and down-woody debris. The forest succession pattern grossly depicted in Appendix A became evident. Large, seral species, such as ponderosa pine, were slowly replaced by shade tolerant climax vegetation such as Douglas-fir or grand fir. Stand replacing fires are less frequent in lodgepole pine forests, which naturally depend on fire to help regenerate the species. The high elevation forests are losing their diverse mosaic character, creating stands with high fuel loads and insect and disease susceptible trees. These stand conditions, historically, seldom occurred naturally and today are producing a situation where high intensity catastrophic fires will occur.

A typical scenario for the sixth successional stage follows (see appendix A): During the early old-growth stage, seral species (if present) usually dominate the tree canopy layer with various sizes of the climax species present in the understory. A few large trees (size is species dependent) and snags are present as the seral species succumbs to various pathogens. Some of the older upper canopy trees reveal the decadence of the stand. They may have dead (spiked) or broken tops with a patchy appearance as their crowns become sparse and contain open areas or "windows;" fire scars or fungi fruiting bodies may be present. The seral species have obtained their mature height, and crown width; and upper crowns may appear rounded. Evidence of disease, insects, and fungi are usually present in the stand. Both climax and seral forbs, grasses, and brush may be present in the understory if such a capability exists. The area begins to develop holes or gaps where trees have died and fallen, allowing climax vegetation to release.

If succession continues the seral species are replaced in the overstory canopy by climax tree species. Usually moderate numbers of large snags, down logs, and woody material are present due to seral tree deaths, caused by pathogens and disturbances. Tree deaths resulting in standing dead and down woody materials, plus some living trees with broken tops or rotting boles contribute to decadence, a necessary attribute of old-growth. Decadent conditions in old-growth result in important snags, logs, and rotting trees that provide potential habitat for several species of birds and small mammals. Decadent conditions also indicate suitable habitat for certain plants which are not easily seen such as saprophytes and lichens which are not readily inventoried. Because forest sites vary in growth and stand development, specific old-growth attributes vary by forest type. As succession advances, as it could with some species, a late sixth stage composed of climax, relatively tolerant species could occur having less patchiness and variation in tree and understory canopy. Decadence of the seral vegetation with its snags, down logs, and rotten trees is less common in this situation. Plant and animal occupancy is also different because of a difference in niche diversity 1/.

This effort to define old-growth recognizes the considerable variability that can exit for specific ecological attributes that characterize late seral and climax stages of development across the geographical range of a given forest cover type. The attribute values identified in this report generally reflect averages across a broad range of habitat types. When compared to similar descriptive efforts for a given cover type located in areas other than those addressed in this report, some variances may be noted in specific attributes as changes in latitude, longitude, or other geographic or topographic changes are encountered.

1/ Thomas, J.W., ed. 1979. Wildlife habitats in managed forests: the Blue Mountains of Oregon and Washington Hdbk No. 553. Washington, DC: Service p. 52.

Method of Determination

A variety of methods were used by each team to develop the specific definition for old-growth for each cover type. All definition teams included ecologists, National Forest and/or District silviculturists, wildlife biologists, and a research silviculturist or ecologist. To assist the team, various members of interested or concerned publics were contacted to obtain information and concerns about old-growth and how it was defined. Interest and input was variable between the six sub-Region team areas.

Data from a variety of sources were used to start the identification process. Each sub-Region team developed minimum standards for old-growth that utilized attributes identified as mandatory by the National old-growth group. Teams used stand examination, forest survey, and other inventory data for National Forest stands to develop old-growth definitions. In addition, the experience of team members was relied on to refine or assist in the development of standards for the definition. Research information, such as habitat type survey plots, was used to identify and confirm definitional standards.

COVER TYPES

Old-growth definitions and descriptions for 12 cover types found in portions of Intermountain Region are developed. Each type description and definition follows the same organization pattern. The cover type name and accompanying SAF type code begin each section. Following those the section is organized as follows:

1. Species Name

2. Description

3. Area of Application

4. Standard Summary of Old-growth Characteristics
   (DBH*, TPA*, and AGE*, columns * indicates required minimums)

5. Description of Attributes

6. Stand Size and Shape

7. Habitat Types Where it Occurs.

Make sure that you read each old-growth definition in its entirety to assure that application is correct and the location is appropriate. Review each SAF cover type to assure appropriate application of the definition.

Each old-growth definition and description conforms to a western forest cover type described between pages 80 to 128 of the publication *Forest Cover Types of the United States and Canada*; F.H. Eyre, Editor, published by the Society of American Foresters, 1980. The old-growth definitions comply with the indexing used in the above publication for the 12 cover types. The index is found on Table 2, page 80 of the publication. The 12 cover types are indexed as follow:

HIGH ELEVATIONS

Engelmann spruce - subalpine fir (206)
Whitebark pine (208)
Bristlecone pine (209)

MIDDLE ELEVATIONS

Interior Douglas-fir (210)
Grand fir (213)
Blue spruce (216)
Aspen (217)
Lodgepole pine (218)
Limber pine (219)

LOW ELEVATIONS, INTERIOR

Interior ponderosa pine (237) (North Plateau Race)
Interior ponderosa pine (237) (Rocky Mountain Race)
Pinyon juniper (239)

SAF COVER TYPE
ENGELMANN SPRUCE-SUBALPINE FIR
CODE 206

Species: *Picea engelmannii* - Engelmann spruce
Abies lasciocarpa - Subalpine fir

Description

The spruce-fir forests, as commonly referred to, have Engelmann spruce and subalpine fir growing in common association. Both species occur in the high-elevation Rocky Mountain forests of the Intermountain Region. They dominate sites with cool and humid climates, long, cold winters, and short, cool summers. Subalpine fir together with Engelmann spruce forms a climax or long-lived seral forest. Each species also can form nearly pure stands. Engelmann spruce is rated as tolerant in its ability to endure shade, but it is less tolerant than subalpine fir. Engelmann spruce is usually a much taller and longer lived species than subalpine fir. Subalpine fir seldom endures for more than 250 years while Engelmann spruce exceeding 450 years is not uncommon. This disparity in age and stand height often influences stand composition; the spruce persists while the fir suffers mortality, regenerates and becomes a secondary canopy in the old stands of spruce.

Pure stands of Engelmann spruce often occur at low elevations along broad valley bottoms where cold air accumulations and high water tables are common. Pure subalpine fir stands are common at the highest elevations of forests where available moisture is a problem. Subalpine fir with its reduced leaf area and smaller canopy area per tree controls transpiration loss; this favors its survival on such sites.

Both species are very susceptible to fire, insects, disease, and wind damage. Fire does not occur frequently in the high elevation, cool-moist zones where the species occur. Both species have very thin bark and are easily affected by even low surface temperature fires. Where accumulations of fuels occur from windthrow or insect mortality catastrophic fires can occur. Such fires would dramatically alter this ecosystem, usually eradicating spruce or fir from the site for periods as long as 300 years.

The spruce beetle is a very serious insect pest for mature and over mature spruce. Several major epidemics were recorded in recent history, usually triggered by a windfall in this rather unstable species. This insect, because of response capability and difficulty in detection, often places large areas with young and old aged spruce at very high risk. Losses can range to several thousand acres in extensive spruce-fir areas and can occur within a few years.

Subalpine fir is subject to several root and butt rotting fungi. Large rot pockets have been found that have limited the occurrence of any subalpine fir. This cover type occurs over a wide area in the Intermountain Region. Old-growth conditions vary considerably depending on growth potential of the site, which is primarily controlled by temperature and moisture during the growing season. On warmer sites blue spruce, Douglas-fir, grand fir, and white fir are often present or adjacent and achieve larger sizes than the subalpine fir. On moister sites, such as riparian valley bottoms, with high water tables, Engelmann spruce predominates, usually achieving much greater size. On colder-drier sites, growth potentials are less, trees are smaller, and subalpine fir is more abundant than Engelmann spruce. Associated species are whitebark pine, limber pine, and alpine larch. Near timberline, transition to the alpine environment, this cover type is often nearly pure subalpine fir with some rare white bark pine, bristlecone pine, or other high-elevation species. In these more open, widely spaced stands subalpine fir reproduces, dominating areas by layering. This vegetative propagation often has one single root system supporting several trees in a large clump.

Area of Application

Although the spruce-fir cover type occupies a great deal of the Intermountain Region the descriptors below allow the old-growth attributes to broadly apply by ecological situation rather than geographic situation. The descriptors and ecological situation are:

1. Warm/moist Environment - Engelmann spruce dominates with some Douglas-fir, grand fir, white fir, aspen, or some subalpine fir present in small amounts. Stream bottoms and accumulating cold air basins are included here, primarily in Idaho.

2. Cold/dry Environment - Subalpine fir dominates Engelmann spruce. Common associated species are white bark pine, limber pine, and alpine larch.

3. Alpine Transition Environment - Open, widely spaced subalpine fir dominates, usually by layering, producing multiple boles from a common root. Stands are strongly wind- and snow-influenced with occasional krummholz or strips of trees between snow drift areas.

Standard Summary of Old-Growth Characteristics

Vegetative Series: Engelmann spruce, Subalpine fir, Grand fir
SAF Cover Type: Spruce - fir
Applicable Area: Intermountain Region
Site Productivity: N/A

Live trees

Main canopy			Variation in tree diameter	Tree decadence	Tree canopy layers
DBH*	TPA*	Age*	6-in Classes	TPA-DBH	Number
Warm/moister environments					
≥20 Utah ≥24 Idaho	≥25	≥220	≥2	Evidence	≥2
Cold/dry environment					
≥15	≥15	≥150 to 180	≥2	≥2-14	≥2
Alpine transition environment					
≥12	≥10	≥150 to 180	≥2	Evidence	≥2

Dead Trees

Standing		Down	
DBH/ht ft	TPA	Diameter (in)	Pieces/acre length in ft (min. length)
Warm/moist environment			
≥12/15	≥2	≥12	≥1-8
Cold dry environment			
10/15	2 to 4	≥8 or >6	≥16-8 ft or 100 pieces >8 ft
Alpine transition environment			
N/A	Infrequent	N/A	Infrequent

Description of Attributes

Live trees

Live trees in a warmer/moist environment: The warmer and/or moister portions of this cover type are the most productive. They support blue spruce, Douglas-fir, grand fir, white fir, and aspen, often mixed with the predominating Engelmann spruce. On such sites subalpine fir may be present but in very small amounts. In some stands, especially with elevated water tables only Engelmann spruce will occupy the site. The taller heights, larger diameters, and longer life spans of Engelmann spruce and Douglas-fir generally preclude dominance by the more shade tolerant fir, with its shorter height and short life span. Old-growth definitions are adjusted accordingly.

At least 20 to 25 trees per acre must have diameters that are 24 inches DBH or greater and be at least 220 years old in Idaho. In Utah diameters are 20 inches DBH or greater because of the higher elevations and slower growth. These stands may appear to be quite old, but if normal insect and disease disturbances are allowed to run their course without fire and strong wind, subalpine fir would eventually dominate. Vegetative reproduction by subalpine fir under heavily shaded conditions is its chief advantage for dominance.

Live trees in a cold/dry environment: Nearly pure stands of subalpine fir are also common in the spruce-fir cover type. These stands can result from successional advances of mixed species stands. They occur on sites where disturbance to Engelmann spruce, harshness of the site and shade competition prevent Englelmann spruce from regenerating. The slow root growth of Engelmann spruce on these sites, which have moderately thick litter and organic layers, also controls regeneration success. Subalpine fir is a prolific seed producer, and its vegetative reproduction system of vegetative layering allows established trees to maintain site dominance. Often large and small trees have a common root system. The large dominant and codominant trees in old-growth stands occur at a minimum rate of 15 trees per acre, and often exceed 25 trees per acre, averaging 15 inches DBH or greater. Minimum tree ages range between 150 and 180 years depending on site harshness. Insects and disease affect individual trees in these stands causing spike tops and top breakage of two standing live trees greater than 14 inches in diameter per acre. These normally occur in scattered clusters throughout a stand.

The lack of reproduction by seed on these sites limits reproduction to layers with a range of diameter classes on the old-growth stands. The lower of the two canopies is made up of small trees formed by basal layering. While there are often two apparent and rather distinct size classes they are often in clumps or random groups on the site.

The old-growth nature of these stands results in horizontal and vertical diversity due to variety of tree sizes. There are at least two recognizable size classes that differ by at least 6 inches in diameter. The size difference also creates at least two canopy layers rather than just small trees in the same canopy layer. Upper canopy coverage ranges from an open canopy created by numerous tree fall gaps to 60 percent canopy closure in the stand. Both even-aged and uneven-aged stands exist depending on disturbances and species occurrence.

Live trees in an alpine transition environment: The most severe sites in this cover type contain pure stands of subalpine fir in the transition zone between subalpine forest and the alpine zone. Old-growth features are not striking. Trees become more widely spaced with much bare ground or rocks evident in the stand. Regeneration by seed is very sporadic, usually occurring in areas of developed or accumulated soils that can hold moisture during dry periods. Subalpine fir also reproduces vegetatively through layering of basal branches. It successfully occupies the available suitable growing sites. Often near the more exposed, harsher environments subalpine fir becomes a krummholz cushion. Natural regeneration occurs mainly where uprooted trees have exposed mineral soil and provided protection from desiccation. Site limitations reduce tree numbers to about 10 per acre with dominant trees averaging more than 150 years old and exceeding 12 inches DBH.

Dead trees

Dead trees in a warm/moist environment: Decadence is perhaps the most important component in old-growth. Down woody material resulting from fallen trees, broken tree tops, or large limbs varies with the production capability of the site. These sites are normally very moist and at times the decay rate may exceed the wood production accumulation rate. However, in the old-growth condition high rates of tree fall should result in at least 16 linear feet of 8-foot and longer pieces that are 10 or more inches in diameter. Dead standing trees may be scarce; small size predisposes them to rapid decay. Two or more snags per acre at least 12 inches DBH and 15 to 20 feet in height should occur randomly in the stand. The rapid decay and strong winds that are common on some of the sites often control the abundance and duration of standing dead trees.

Dead trees in a cold/dry environment: Dead standing tree are less scarce than in the moister and warmer areas because of less fungal activity. Although small in size, as few as two, but more commonly at least four standing dead trees, at least 10 inches DBH and 15 feet in height should occur in the stands.

These stands usually have smaller pieces resulting in 16 or more linear feet of 8-foot and greater pieces that are at least 8 inches in diameter. Sometimes tree fall rates are very high--running to more than 100 pieces 8 feet in length and 6 inches in diameter. The amount of accumulation often depends on the kind of seral species present.

Dead trees in an alpine transition environment: These areas have infrequent accumulations of down-woody debris and standing dead trees due to low production rates and general stand character. Debris is infrequent and sporadically distributed.

Stand Size and Shape

Ten acres or more. Past inventory procedures have classified stands as 10 acres or larger. Minimum variable sizes and shapes of old-growth have not been determined. Values for such items as wildlife, recreation, biological diversity, and juxtaposition of old-growth stands with other forest conditions need to be considered in relation to Forest land management planning objectives. However, 10 acres is a practical minimum for mapping and inventory identification procedures. The minimum does not establish a management strategy for old-growth.

Some stands to be evaluated against old-growth attributes may not be in a totally undisturbed condition. Some minor tree removal may have occurred in the form of tree mortality salvage, snag removal, and other selection harvesting. Judgement must be used in completion of old-growth condition evaluations.

Habitat Types Where It Occurs

Climax Grand fir - seral Engelmann spruce

*Abies grandis/*Vaccinium globulare*
*/*Linnaea borealis/Vaccinium globulare*
*/*Clintonia uniflora*

Climax Engelmann Spruce

*Picea engelmannii/*Hypnum revolutum*
*/*Carex disperma*
*/*Equisetum arvense*
*/*Caltha leptosepala*
*/*Physocarpus malvaceus*
*/*Galium triflorum*
*/*Linnaea borealis*
/Vaccinium scoparium
/Juniperus communis
/Ribes montigenum
/Amica cordifolia

Climax subalpine fir - seral Engelmann spruce

*Abies lasiocarpa/*Caltha biflora*
*/*Calamagrostis canadensis*
*/*Streptopus amplexifolius*
*/*Clintonia uniflora*
*/*Menziesia ferruginea*
*/*Acer glabrum*
*/*Linnaea borealis*
/Xerophyllum tenax
*/*Vaccinium globulare*
*/*Spiraea betulifolia*
*/*Calamagrostis rubescens*
/Carex geyeri
/Juniperus communis
/Arnica cordifolia
/Vaccinium caespitosum
/Luzula hitchcockii
/Vaccinium scoparium
/Ribes montigenum
*/*Actaea rubra*
*/*Physocarpus malvaceus*
*/*Osmorhiza chilensis*
/Arnica latifolia
/Thalictrum occidentale
*/*Aconitum columbianum*
*/*Carex rossi* (in part)
/Pedicularis racemosa
/Berberis repens (in part)
/Symphoricarpos albus
/Vacinnium myrtillus

(*These habitat types constitute the major portion of the spruce-fir cover type that supports Douglas-fir and Engelmann spruce as major species. Consider these warm/moist environments).

SAF COVER TYPE
WHITEBARK PINE
CODE 208

Species: *Pinus albicaulis* - Whitebark Pine

Description

Whitebark pine grows in association with lodgpole pine and subalpine fir in high-elevation subalpine forests but only in a climax condition at or near timberline. Where whitebark pine forms climax communities or where it predominates, it occurs on young soils with little or no horizon development, coarse talus, exposed bedrock or lava flows. The general climate where whitebark pine forms climax communities is normally cold with extreme seasonal changes, a short growing season, and has high-volume, long-duration snow cover with frequent fierce winds. The sites where whitebark pine is most abundant are warm-dry in moist mountain ranges and cool-moist in semi-arid ranges.

Whitebark pine is slow growing with a life span of up to 700 years, usually producing moderate sized trees in 250 or more years. Where whitebark pine grows in association with lodgepole pine and subalpine fir its of tree form with a single stem, moderate height, and crown characteristics similar to lodgepole pine. However, at high elevations it grows in open stands and has a multi-stemmed form and is short with a diffuse crown capable of producing large cone crops. The multi-stemmed character is due to seed caching habits of the Clark's nutcracker and to natural branching habits of young whitebark. At the highest elevations whitebark pine forms "krummholz" stands of shrub like trees with long prostrate, twisted limbs growing among protecting rocks. Whitebark appears to have moderate light tolerance at all ages but tends to reproduce and grow best in openings.

Light frequent fires during pre-settlement times maintained high levels of whitebark pine by eliminating more shade tolerant associates such as Engelmann spruce and subalpine fir. The low levels of fuel accumulation appeared to keep the infrequent natural fires at low intensities. Because of fire suppression efforts the number and size of fires in whitebark pine communities have declined which has given shade tolerant species a competitive advantage.

Whitebark pine populations are severely affected by mountain pine beetle and blister rust. The mountain pine beetle does not survive well in high-elevations stands because of climatic influence on brood survival. Mountain pine beetle epidemics often start in lower elevation lodgepole pine forests and spread up into whitebark pine stands. Blister rust causes major mortality in the northwest portion of whitebark pine's range, however, in dryer regions rust does not cause appreciable damage.

Area of Application

The whitebark pine cover type occurs in the Intermountain Region principally in National Forests in Southern Idaho and in many high-elevation stands on the Bridger-Teton National Forest in Wyoming. The highest concentration of whitebark pine found anywhere occurs in and around Yellowstone National Park. A few isolated areas of whitebark pine occur in Nevada, mainly in the northeastern corner and in small stands along the California border.

This description deals only with areas where whitebark pine occurs in pure stands or makes up the plurality of stocking.

Standard Summary of Old-Growth Characteristics

Vegetative Series: Engelmann spruce, subalpine fir, bristlecone pine, and whitebark pine
SAF Cover Type: Whitebark pine
Applicable Area: Intermountain Region
Site Productivity: N/A

SERAL AND CLIMAX

Live Trees

Main canopy			Variation in tree diameter	Tree decadence	Tree canopy layers
DBH*	TPA*	Age*	6-in Classes	TPA-DBH	Number
≥18	≥15	≥250	≥2	≥2-15	≥2

Dead Trees

Standing		Down	
DBH/ht ft	TPA	Diameter	Pieces/acre length in ft (min. length
≥15-10	≥5	≥20	5-8 ft

Description of Attributes

Live trees

Stands of old-growth whitebark pine are characterized by mature whitebark pine but may also contain Engelmann spruce, subalpine fir, lodgepole pines, and limber pine. The larger dominant and codominant trees within these stands average greater than 18 inches in diameter (DBH or DRC) and exceed 250 years of age, with a minimum of 15 trees per acre in that overtopping canopy. This is considered the minimal configuration for an old-growth stand. The slow rates of growth and poor growing conditions are recognized factors that limit stand development. Due to within clump competition some trees may reach maximum longevity and begin to die without reaching 18 inches in diameter.

Horizontal and vertical diversity are components of old-growth. Horizontal diversity in whitebark pine is represented by at least two 6 inch diameter classes and 30 percent canopy closure in the occupied stand areas. Two distinct canopy layers are present although, the layers are random and may be sporadic. Trees may be even-aged with a repressed canopy layer. Extremely open stands may have two or more age classes.

Decadence, expressed as damaged, broken, dead, or spiked top trees is common in old-growth whitebark pine. At least two trees greater than 15 inches DBH will show decadence and occur randomly, although sometimes clumped through a stand.

Dead trees

Standing dead trees or snags, are randomly distributed. These trees would be 15 inches in diameter and occur at the rate of about five per acre.

Down woody debris, which is slow to deteriorate because of the cold environment would occur at the rate of five pieces, greater than 8 feet in length, per acre and 20 or more inches in diameter at the large end.

Stand Size and Shape

Ten acres or more. Past inventories have classified stands as 10 acres or more for ease in mapping and inventory purposes only. Minimum old-growth stand size and configuration have not been determined at this point. Surrounding stand conditions and management objectives should be considered in determining old-growth stand size.

The shape of whitebark pine stands varies, but can have a distinct horizontal upper boundary when stands occur at timberline lower elevational boundaries tend to overlap considerably in dryer site stands of lodgepole pine and limber pine.

Habitat Types Where It Occurs

This list only identifies these habitat types where whitebark pine could be the predominate tree species.

Seral Whitebark Pine

Abies lasiocarpa/Vaccinium scoparium/Pinus albicaulus
/Arnica latifolia
/Juniperus communis
/Ribes monigenum/Pinus albicaulis
/Pedicularis racemosa
/Arnica cordifolia
/Luzula hitchcock

Picea engelmannii/Vaccinium scoparium
/Hypnum revolutum
/Juniperus communis
/Ribes montigenum
/Arnica cordifolia

Climax whitebark pine

Pinus albicaulis/Festuca idahoensis
/Vaccinium scoparium
/Juniperus communis
/Carex geyeri
/Juniperus communis
/Carex rossi

SAF COVER TYPE
BRISTLECONE PINE
Code 209

Species: *Pinus longaeva* - Great Basin bristlecone pine

Description

Great basin bristlecone pine is located primarily at higher elevations. It is considered a very unusual cover type because it contains the world's oldest trees. This slow growing, long-lived tree tends to grow in open, generally pure, even-aged stands. The sites it occupies are typically dry, rocky, and windswept. Many trees in the type exceed 3,000 years in age. These gnarled, weather-beaten trees are very esthetic and have considerable scientific interest for dendrochronology purposes.

The high-elevation harsh sites where the species form the climax vegetation are open stands that have a few other associated species such as Engelmann spruce and limber pine. Bristlecone pine occurs at lower elevations, but is usually dominated by other species that appear to be more shade tolerant; it survives because of its longevity. Bristlecone appears to be moderately shade intolerant. The usually open-grown stand has an understory composed of much rock and a few shrubs, grasses, or herbaceous plants. Much of the Great Basin bristlecone pine occurs in a few areas of soil accumulation in the windy near-timberline environment. With favorable soils and moister growing conditions, bristlecone pine grows to good size. However, its ability to survive on very harsh sites appears to be phenomenal. Reasons for the species' longevity are not easily explained.

Area of Application

Great Basin bristlecone occurs primarily in the mountains of the Great Basin and plateaus in Nevada, Utah, and eastern California. Another species, the Colorado bristlecone pine (*pinus aristata*), occurs east of the Colorado river.

Standard Summary of Old-Growth Characteristics

Vegetative Series: Limber pine, subalpine fir, Engelmann spruce
SAF Cover Type: Bristlecone pine
Applicable Area: Nevada, Utah west of the Colorado, Green River drainage
Site Productivity: Low

Live Trees

Main canopy			Variation in tree diameter	Tree decadence	Tree canopy layers
DBH*	TPA*	Age*	6-in Classes	TPA-DBH	Number
>10	5	300	N/A	N/A	N/A

Dead Trees

N/A	N/A

Description of Attributes

Not enough information is currently available to determine stand attributes appropriate to old-growth. In most cases diameters greater than 10 inches, with more than five trees per acre that are 300 years of age are sufficient attributes to meet the minimal old-growth requirements for these stands. Seldom are standing dead or down-dead materials found on these sites. These are considered temporary criteria until more investigation has been completed. Most of the high-elevation stand will become old-growth because there are few disturbances.

Stand Size and Shape

No stand size has been determined yet.

Habitat Types Where It Occurs

No habitat types have been formally identified. It was identifies as a co-climax species with limber pine in central and southern Utah by A.P. Youngblood and R.L. Mauk 1985 Coniferous Forest Habitat Types of Central and Southern Utah. Gen. Tech. Rpt. INT-187, Intermountain Research Station, Ogden, Utah USDA Forest Service page 40-41.

SAF COVER TYPE
INTERIOR DOUGLAS-FIR
CODE 210

Species: *Psuedotsuga menziesii* variety glauca - Rocky Mountain Douglas-fir

Description

Rocky Mountain Douglas-fir grows in extensive pure stands, that are both even and uneven-aged in southern Idaho, western Wyoming, and Utah. It also occurs associated with a broad belt of other species, between the lower elevation ponderosa pine and the upper elevation spruce-fir zones. It is associated with a variety of species.

Douglas-fir can be either a seral dominant or a climax dominant on a wide range of sites and is associated with several species. Old-growth Douglas-fir shall be stratified into these different situations. Each situation is defined by the species variable response. The responses are associated with the productivity of the site and general situation of occurrence. These situations are described as follows:

1. Douglas-fir on dry or colder, lower productivity sites with the following attributes:

    a. Douglas-fir often the seral dominant as well as the climax dominant. Engelmann spruce or subalpine fir also are the climax habitat type series. Lodgepole pine occasionally is seral.

    b. Under growth variable, ranging from shrub layers to scattered, dry-site grasses. Some dry sites have open-forest, savannah appearance.

    c. Dryer, low production of understory vegetation.

2. Douglas-fir often with ponderosa pine a common seral species occurs on moist higher productivity sites.

    a. Ponderosa pine, a vigorous seral, dominates the early stages in most habitat types.

    b. Lodgepole pine may also be a vigorous early dominant, seral component in a few habitat types.

c. Undergrowth varies from moist forbs, to dense gramnoids, to well developed mid to tall shrubs, such as mountain maple.

d. Site productivity > *70* cubic feet/acre/year, characterized by both, rapid height and diameter growth rates, and larger numbers of trees/acre.

This cover type historically was influenced by natural events and mans activity. The steep, rugged terrain that much of the Rocky Mountain Douglas-fir species occupied reduced mans activity in many areas. Although selection harvesting and livestock grazing has occurred it was primarily at the lowest elevations. Fire's recurrence in the cover type has limited or controlled the amount of Douglas-fir on sites where it is considered climax. Often ponderosa or lodgepole pine was maintained by frequent, low intensity fires.

In areas where Douglas-fir is climax, open park like stands are common with only clumpy patches of Douglas-fir seedlings and saplings in the understory. Douglas-fir up to pole size is very sensitive to fire, hence an understory was usually excluded. The institution of fire control programs dramatically altered the stand character of many Douglas-fir areas. Stand structures are developing that were never common prior to settlement.

Rocky Mountain Douglas-fir is often dramatically restructured at older ages by several biological agents. Douglas-fir bark beetle attacks often create large groups of dead trees forming regeneration gaps. Two defoliating insects, western spruce budworm and tussock moth, are also responsible for dramatic losses in parts of the tree canopy, through death of large numbers of trees over extensive areas. These three very destructive pests, in concert with other biological agents, can cause a dramatic re-structuring of Douglas-fir stands over large areas especially when of advanced age. Dwarf mistletoe is often present pre-disposing stands to higher intensity fires and less vertical structure from young trees.

Area of application

Rocky Mountain Douglas-fir occurs throughout the Intermountain Region. However, only in southern Idaho and western Wyoming does it occur in large contiguous areas. In Utah and parts of eastern Nevada it occurs primarily as small to moderately large discontinuous forested areas scattered among the mountains and plateaus. Areas of high site productivity are found on the Boise and Payette, with much smaller amount on the Sawtooth and Salmon National Forests. The remaining areas, generally fit into the lower site productivities. The separation of higher and lower site productivity is identified below in the section Habitat Types Where It Occurs. There are also some very low productivity sites that are also identified by habitat type.

The area occupied by Douglas-fir is generally controlled by temperature and moisture. In the southern part of its distribution Douglas-fir will normally be found only on slopes or situations where moisture is abundant and with late spring and early fall frosts uncommon.

STANDARD SUMMARY OF OLD GROWTH CHARACTERISTICS

Vegetative Series: Douglas-fir, Grand fir, White fir, Engelmann spruce, and Subalpine fir
SAF Cover Type: Interior Douglas-fir
Applicable Area: Intermountain Region
Site Productivity: N/A

SERAL AND CLIMAX

Live Trees

Main canopy			Variation in tree diameter	Tree decadence	Tree canopy layers
DBH*	TPA*	Age*	6-in Classes	TPA-DBH	Number
Higher productivity sites					
24	≥15	≥200	≥2	Evident	≥2
Lower productivity sites					
18 (14)*	10 (5)**	≥200 (-25yr)	≥2	≥2-15	≥2

Dead Trees

Standing		Down	
DBH/ht ft	TPA	Diameter (in)	Pieces/acre length in ft (min. length)
Higher productivity sites			
20-20	≥1	≥12	≥0-16
Lower productivity sites			
16-10	Variable-3 0-3	≥15 large end	Infrequent 4-≥8

Note:

( )* Minimum diameter of Douglas-fir/heartleaf arnica lowest productivity sites or common juniper habitat types.

( )** Minimum trees per open savannah and/or dry, harsh sites.

Description of Attributes

Live trees

Live trees on lower productivity sites: are characterized by an over topping canopy of Douglas-fir in either late seral or climax successional stage. Larger dominant and co-dominant trees within the stand equal or exceed 18 inches in diameter. There are 10 or more tree per acre in the over topping canopy that is 200 years or older, except where other minimums are met. Height growth has almost ceased resulting in flattening of the upper crown. A reduced minimum diameter of 14 inches is necessary for the poor site quality the Douglas-fir heartleaf arnica and common juniper habitat types as well as a reduction by 25 years of the minimum age, or dry, harsh sites the minimum is reduced to five dominate trees per acre.

Live trees on higher productivity sites: The principal difference from the lower productivity sites minimums are the larger minimums 24 inches in diameter and an age exceeding 200 years. More productive sites reach the larger diameters quicker and usually survive to older ages with less risk from pathogens and insects.

Diameter classes, canopy layers and tree decadence: Horizontal and vertical diversity are important attributes of old-growth. Stands shall have a variety of tree ages and sizes, at least two 6 inch diameter classes will be recognizable. The diameter difference should also create at least two layers in the tree canopy rather than just smaller diameter trees in the same layer. Pathogens and insects have a variable influence on these stands. Lower productivity sites due to higher drought and other stresses have at least 2 damaged live trees with a broken or dead top and/or deformed boles that are randomly distributed.

Dead trees

Dead trees in most stands have snags from 16 inches in diameter on the lower productivity sites to 20 inches on the higher productivity sites. On the lower productivity sites more snags are apt to be found because of the more stressful environment. One or less snags per acre will be found on higher producing sites. On lower productivity sites three or less snags is the average per acre. Snags commonly occur in groups throughout the stand seldom occurring as individuals scattered throughout an area. Insects, root, and stem pathogens, and fire are the principle agents causing the development of snags.

Higher Productivity Sites:

Down woody material is quite variable on these sites because they are more productive, with a higher capability for rotting the debris. Debris that is small in size does not persist long, thus little remains at this stage. Only large woody debris remains which ranges from zero to 16 linear feet of 12 inches diameter at the small end. Down debris is usually clumpy and associated with tree fall.

Lower Productivity Sites:

These sites have low to moderate debris occurrence rates due to the lack of rotting fungi action. The material is principally broken tree pieces that exceed 8 feet in length. It ranges from zero to four pieces per acre which are 15 or more inches in diameter at the large end.

Stand Size and Shape

Ten acres or more. Past inventory procedures have classified stands as containing 10 acres or larger. Viable old growth stand sizes and configuration have not been determined at this point. When other values such as wildlife needs, recreation desires and bio-diversity concerns and surrounding stand conditions have been considered the size can be determined. In addition management objectives, appropriate stand sizes and boundary should also be used in the determination.

Some stands to be evaluated against old growth attributes may not be in a totally undisturbed condition. Some minor tree removals may have occurred in the form of mortality salvage, snag removal, and other harvests. This means that some judgement must be used in evaluating old-growth conditions.

Habitat Types Where It Occurs

Lower Productivity Site
Climax Douglas-fir

Psuedotsuga menziesii/Agropyron spicatum (open savannah)
/Festuca idahoensis (open savannah)
/Symphoricarpos oreophilus
/Arnica cordifolia (lowest savannah)
/Juniperus communis (lowest savannah)
/Carex geyeri
/Berberis repens
/Cercocarpus ledifolius (open Savannah)
/Calamagrostis rubescens
/Osmorhiza chilensis
/Spirea betulifolia
/Symphoricarpos albus
/Physocarpus malvaceus
/Physocarpus monogynus
/Arctostaphylos patula (open savannah)
/Cercocarpus montanus (open savannah)
/Quercus gambelii

Seral Douglas-fir - Climax Engelmann spruce

Picea engelmanii/Hypnum revolutum
/Juniperus communis
/Linnaea borealis
/Arnica cordifolia

Lower productivity sites (cont'd)
Seral Douglas-fir - Climax subalpine fir

Abies lasciocarpa/Juniperus communis
/Physocarpus malvaceus
/Arnica latifolia
/Vaccinium globulare-Pachistma myrsinites phase
/Symphoricarpos albus
/Thalictrum occidentale
/Osmorhiza chilensis
/Spirea befulifolia (in part)
/Calamagrostis rubescens (in part)
/Arnica cordifolia
/Actea rubra
/Berberis repens

Seral Douglas-fir - Climax white fir

Abies concolor/Physocarpus malvaceus
/Osmorhiza chilensis
/Berberis repens
/Acer glabrum
/Cercocarpus ledifolius
/Arctostaphylos patula
/Quercus gambelii
/Juniperus communis
/Symphoricarpos oreophilus

Seral Douglas-fir - Climax Blue spruce

Picea pungens/Berberis repens
/Agropryron spicatum

Higher Productivity Sites
Climax Douglas-fir

Psuedotsuga menziesii/Acer glabrum

Seral Douglas-fir - Climax Grand fir
Abies grandis/Calamagrostis rubescens
/Spirea betulifolia
/Vaccinium globulare
/Acer glabrum
/Linnaea borrealis
/Vaccinium caespitosum (in part)
/Clintonia uniflora

Seral Douglas-fir - Climax Subalpine-fir

Abies lasciocarpa/Clintonia uniflora
/Acer glabrum (in part)
/Linnaea borealis/Linnaea borealis
/Xerophyllum tenax/Vaccinium globulare (in part)
/Xerophyllum tenax/Vaccinium scoparium (in part)
/Vaccinium globulare
/Spiraea betulifolia (in part)
/Calamagrostis rubescens (in part)
/Carex geyeri-Carex geyeri (in part)

SAF COVER TYPE
GRAND FIR
CODE 213

Species: *Abies grandis* - Grand fir

Description

Grand fir, a shade tolerant species, is a climax species on the sites where it occurs in the Intermountain Region. Grand fir predominates in these stands and makes up the plurality of stocking. In the absence of fire, it will replace its common associates--ponderosa pine, Douglas-fir, western larch, lodgepole pine, and Engelmann spruce. The shade tolerance of the species allows it to establish itself under brushy conditions, therefore, there may not be any of its less shade tolerant associated species present in these conditions. As a result of low intensity surface fires, frost cracks, and other bole injuries many stands have a large proportion of trees with defects that have bole and root rotting fungi. In the Intermountain Region grand fir is considered a hybrid of grand fir and white fir exhibiting true traits of both.

Area of Application

In the Intermountain Region grand fir is found only on the Boise, Payette, and Salmon National Forests of southern Idaho.

Standard Summary of Old-Growth Characteristics

Vegetative Series: Grand Fir
SAF Cover Type: Grand Fir
Applicable Area: Boise, Payette, Salmon NF's
Site Productivity: Moderate-High

Live Trees

Main canopy			Variation in tree diameter	Tree decadence	Tree canopy layers
DBH*	TPA*	Age*	6-in Classes	TPA-DBH	Number
≥24	≥15	≥200	≥2	Evidence	≥2

Dead Trees

Standing		Down	
DBH/ht ft	TPA	Diameter	Pieces/acre length in ft (min. length
20-20	≥2	≥12	2-25

Descriptions of Attributes

Live trees

When a combination of 15 or more trees per acre occur in the overtopping canopy, with a minimum diameter breast height (DBH) of 24 inches and an age of 200 years or older, old-growth characteristics are evident. These trees can be any species on the site meeting the trees per acre (TPA), diameter (DBH), and age requirements. The minimums are not absolute so minor variations may be acceptable if other characteristics are present.

The old-growth nature of these stands results in a variety of tree ages and sizes. Consequently, there should be at least two recognizable size classes that differ by at least 6 inches in diameter. The size difference should also create at least two layers in the tree canopy rather than just smaller diameter trees within the same layer. These attributes are necessary for the structural diversity common to old-growth stands in this cover type. The upper-most tree canopy may be quite open with natural openings created by fallen trees.

Dead trees

Insects, root and stem pathogens, and fire are the principal agents resulting in snags in the grand fir series. A minimum of two snags larger than 20 inches DBH and at least 20 feet in height would be found in an old-growth stand. Smaller snags less than 20 inches DBH would also be common. Snags would commonly occur randomly in groups throughout the stand and seldom on each individual acre.

Down-woody material is measured by the length of the dead material segments which are at least 12 inches in diameter at the small end. It is a function of site productivity, age, and the degree of decadence in each stand. We would normally expect more down material than the minimum two pieces totaling 25 lineal feet, but past fire activity influences the amount of material on site.

Stand Size and Shape

Ten acres or more. Past inventory procedures have classified stands as 10 acres or larger. Viable old-growth stand sizes have not been determined at this point. Surrounding stand conditions should be considered in determining old-growth stand size in addition to management objectives.

Habitat Types Where It Occurs

This cover type is associated with the *Abies grandis* habitat type series.

Abies grandis/calamagrostis rubescens
/Spiraea betulifolia
/Vaccinium globulare
/Acer glabrum
/Linnaea borealis
/Vaccinium caespitosum
/Clintonia uniflora

SAF COVER TYPE
BLUE SPRUCE
CODE 216

Species: *Picea pungens* - Blue Spruce

Description

Blue spruce is native to the central and southern Rocky Mountains. This slow growing, long lived species, of medium size is found growing in the cool and humid zone. Most of its annual moisture occurs during the growing season. It's moderate in shade tolerance.

Blue spruce grows on sites that are usually more moist than those of ponderosa pine but warmer than those of Engelmann spruce and subalpine fir. It is found growing in the montane zone; on gently sloping upland and subirrigated areas, in well watered tributary drainages, extending down intermittent streams, and on northerly slopes. Because of its growth character it occurs with a variety of streamside or riparian hardwoods such as as aspen, cottonwood, water birch, willow, and others. In Utah blue spruce is considered a climax species in three environments; gentle to steep mountain slopes, flood plains and valley bottoms, and montane sites on alluvium or aqueous north-aspect deposits. Often these sites have soils derived from sedimentary parent material. The species is successful because it withstands drought and low temperatures successfully.

The areas that blue spruce occupies, normally are not large or extensive. It often grows in almost pure stands. On dryer slopes it may be open and broadly spaced. It often occurs as isolated stands or groups of trees.

Although a slow growing species blue spruce has good longevity. Trees 18-22 inches DBH may be 275-300 years old. Fire is not a dominate influence in blue spruce stands, although its thin bark makes it quite susceptible to damage. While numerous species of insect and disease affect blue spruce no single species has a major influence on them.

Area of Application

In the Intermountain Region Blue spruce is confined principally to southeastern Idaho, western Wyoming, and Utah.

STANDARD SUMMARY OF OLD GROWTH CHARACTERISTICS

Vegetative Series: Blue Spruce, Subalpine fir, and White fir
SAF Cover Type: Blue Spruce
Applicable Area: Targhee, Bridger-Teton, Caribou, Wasatch-Cache, Uinta, Ashley, Fishlake, Manti-LaSal, and Dixie National Forests
Site Productivity: N/A

Live Trees

Main canopy			Variation in tree diameter	Tree decadence	Tree canopy layers
DBH*	TPA*	Age*	6-in Classes	TPA-DBH	Number
≥16	≥10	≥250	≥3	≥1-14	≥3

Dead Trees

Standing		Down	
DBH/ht ft (in)	TPA	Diameter (in)	Pieces/acre length in ft (min. length
3-10	0-1	3-10	Infrequent

Description of Attributes

Live Trees

Sites are moderately open with trees grouped or in narrow stringers associated with riparian areas. Larger stands in the forest montane situation will be denser. Old-growth situations are difficult to identify due to the limited number of larger stands and the character of the sites. When a stand has 10 or more trees per acre in the overstory canopy that are greater than 16 inches in diameter and 250 years of age or older it is developing old-growth character.

Three diameter classes that differ by more than 6 inches should be present. At least three canopy layers are present but the understory layer may be patchy.

Decadence in the stand is expressed by trees with dead or broken tops, and deformed boles. There should be a minimum of one tree per acre larger than 14-inch DBH with these characteristic's. Pathogens and other affecters are limited in the blue spruce type, but their sporadic influence may cause these trees to be clumpy over the stand.

Dead Trees

Standing dead trees, snags, are seldom present in the type. Usually there will be less than one per acre. This is due to the rapid breakdown of the trees that are affected.

Little down and dead woody material will be present in these stands. Root rot will cause some toppling. What material is present is small, dead trees three or more inches in diameter. These are trees lost to density related mortality. These are usually scattered and often clumpy in distribution.

Stand Size and Shape

Ten acres or more. Minimum sizes and shapes of old-growth stands have not been determined. The juxtaposition of old-growth stands in concert with the stand conditions and management objectives should be considered in determining the stand size and shape. A practical inventory and mapping size has been 10 acres or more. This ten acre stand size does not establish management strategies for old-growth.

Some stands to be evaluated for old-growth attributes may not be in a totally undisturbed condition. Some minor tree removal may have occurred to deal with salvage, snag removal or large individual high value trees. This means that some judgement must be used in evaluating old-growth condition.

Habitat Types Where It Occurs

Community types

Picea pungens/Populus angustifolia
/Potentila fruticosa
/Cornus-salix

Habitat Types

Picea pungens/Equisetum arvense
/Juniperus communis
/Agropyron spicatum

Occasionally also in these Habitat Types

Abies lasiocarpa/Berberis repens
/Juniperus communis

Abies concolor/Berberis repens
/Juniperus communis

SAF COVER TYPE
ASPEN
CODE 217

Species: *Populus tremuloides* - Quaking aspen

Description

Aspen is the most widely distributed forest type in North America. Over its extensive range it associates with a number of tree species. Generally, aspen forests are considered seral to conifer forests over much of its range. However, aspen forests are also noted for their stability. Aspen in the Intermountain Region constitutes a typical topo-edaphic climax at the lower elevations of the upper montane and subalpine forests. Extensive stands are usually attributed to repeated wildfires and in some instances to excessive grazing. Aspen is an aggressive pioneer usually dominating sites until replaced. That replacement process may take up to 1,000 years of fire exclusion.

In the Intermountain Region aspen is considered a permanent (stable) type on some sites. Conifers would invade the type if seed trees were available. In some instances the un-evenaged character in some aspen stands indicates a *de facto* climax.

The principal separation between seral and stable (*de facto* climax) aspen stands seems to be tied to the presence of specific indicator species, Muegeller (1988) in "Aspen Community Types of the Intermountain Region" identified types as: stable, seral to conifers, and grazing disclimax. The stable and grazing disclimax situations represent long-term persistent aspen stands where the conditions tied to the Forest Service generic definition of old-growth can be met.

Seral stands have vigorous and abundant conifer reproduction in the tree canopy layer that constitutes more than 10 percent of the layer. The stable stands have little or no conifer reproduction, thus less than 10 percent of the tree canopy is conifer. A grazing disclimax is much more difficult to determine, but is of little concern because of the lack of conifers.

Old-age is a relative term with aspen. Stands of aspen seldom persist for more than 200 years. However, root systems, where most regeneration occurs, persist up to 8,000 years, research suggests.

Aspen aerial shoots are moderately short lived. Life span is controlled primarily by site capability, elevation, and biologically damaging agents. Aspen stands older than 100 years are usually affected by heart and butt rotting fungi, plus species of several canker. These stable aspens stands are typically characterized as late mature or seral stage five (see appendix A). The time in this stage is usually short because of the number and virulence of pathogens.

Area of Application

The old-growth aspen definition applies only to the stable (aspen is both seral dominant and potentially climax-dominant) and grazing disclimax (severe alteration from past intense grazing) stands. The seral stands may contain what may qualify as old-growth, but its maintenance would require a treatment to remove the competing conifers. Stable and disclimax stands are located primarily in northern Wyoming, southeastern Idaho, Utah, and Nevada.

Standard Summary of Old-growth Characteristics

Vegetative Series: Quaking Aspen
SAF Cover Type: Aspen
Applicable Area: Southern Idaho, N. Wyoming, Utah, and Nevada
Site Productivity: N/A

Live Trees

Main canopy			Variation in tree diameter		Tree decadence	Tree canopy layers
DBH*	TPA*	Age*	6-in Classes	TPA-DBH	Number	
≥12	10 dry 20 mesic	100	≥2	N/A	≥2	

Dead Trees

Standing		Down	
DBH/ht ft	TPA	Small diameter (in)	Pieces/acre length in ft
≥10-15	2	8	≥10-10

Description of Attributes

Live trees

A 100-plus year old stand that contains trees greater than 12 inches in diameter; and ranges from 10 trees per acre on dry sites to 20 trees per acre on the more mesic environments. These large diameter trees dominate a canopy of smaller diameter trees that may overtop clumped or uniformly distributed seedling and sapling sizes. Two or more 6-inch diameter classes will be common.

Dead trees

On the average four snags at least 10 inches in diameter and 15 feet or greater in height per acre will occur in the stand. The snags would be created primarily by various fungi killing trees. Clumps of dead trees are common.

Dead material that is on or near the ground is composed primarily of 10 large trees broken or blown down that are larger than 8 inches at the small end and 10 feet in length.

Stand Size and Shape

Ten acres is the minimum area identifiable with normal inventory procedures. Viable old-growth stand sizes have not been determined at this point. Surrounding stand situations plus area management objectives should be considered in determining old-growth stand size.

Habitat Types Where It Occurs

Stable Community Types:

Populus tremuloides/tall forb (contains 1 or more of 9 forbs)
/Calamagrostis rubescens
/Thalictrum fendleri
/Carex rossii
/Symphoricarpos oreophilus/tall forb
/Symphoricarpos oreophilus/Calamagrostis rubescens
/Symphoricarpos oreophilus/Thalictrum fendleri
/Amelanchier alnifolia-Symphoricarpos oreophilus/tall forb
/Amelanchier alnifolia-Symphoricarpos oreophilus/ Thalictrum fendleri
/Amelanchier alnifolia-Symphoricarpos oreophilus/ Calamagrostis rubescens

Eighteen other stable minor and incidental aspen community types can be found in W.F. Mueggler, December 1988 "Aspen Community Types of the Intermountain Region" General Technical Report INT-250, Ogden, Utah USDA Forest Service Intermountain Research Station page 135.

Major Grazing Disclimax Community Types:

Populus tremuloides/Bromus carinatus
/Symphoricarpos oreophilus/Bromus carinatus

An additional five minor and incidental aspen community types indicating a grazing disclimax are found in the above publication.

SAF COVER TYPE
LODGEPOLE PINE
CODE 218

Species: *Pinus contorta* variety *latifolia* - Rocky Mountain lodgepole Pine

Lodgepole pine is the most widespread tree species in western North America. Three broadly scattered subspecies comprise the species and are affiliated with specific geographic regions. The tall growing, small average diameter variety of the species is referred to as the Rocky Mountain variety (var. latifolia) of lodgepole pine. This is the principal variety of lodgepole pine found in the Intermountain Region. However, on Toiyabe National Forest the larger sized sierra variety (var. murrayana) is found. This general description only covers the Rocky Mountain variety.

Lodgepole pine is highly intolerant to shade. In the Intermountain Region it is commonly associated with a variety of species, but primarily Douglas-fir, Engelmann spruce and subalpine fir in the Intermountain Region. Lodgepole pine seldom persists for extended periods in moderate, mesic environments where it is usually a minor seral species. However, in three other successional roles lodgepole pine is obvious in its extended presence. They are:

1. Dominant seral role,

2. persistent seral role and,

3. climax species role.

The dominant seral role of lodgepole pine has it occupying the site for 100 to 200 years. In these stands more shade tolerant species are present and will replace the lodgepole pine in the absence of fire. In these circumstances old-growth characteristics are usually not found because stand density is usually too high to allow large tree sizes defined for old-growth. Without fire, dominant lodgepole pine stands are succeeded by more shade-tolerant longer-lived associated species, which may reach old-growth conditions as another cover type--such as spruce-fir or Douglas-fir.

In the persistent seral and climax species roles the lodgepole pine cover type can develop ecological old-growth characteristics. They are discussed separately but in general have the same characteristics described in the tables and old-growth characteristics standard summary.

Persistent seral lodgepole pine stands reflect vegetation characteristically present due to recurring disturbances. The habitat type of these stands usually reflect a more shade tolerant species as it's potential occupant. However, lack of seed source, extreme density of lodgepole pine and light, recurrent, surface fires, allow predominance of lodgepole pine. This long lived seral role lodgepole pine is described as persistent seral old-growth lodgepole pine. The probable habitat types where it occurs are identified also.

In some areas lodgepole pine is found as self-regenerating and is considered a climax habitat type species. Lodgepole pines ability to withstand cold, poorly drained and/or low soil nutrient levels appears responsible for its site dominance. This situation is usually found well within the subalpine zone on sites too cold for ponderosa pine or Douglas-fir and too dry for subalpine fir or Engelmann spruce. Topographic or edaphic factors seem to be responsible for the absence of other conifers.

In the Rocky Mountains the mountain pine beetle and fire have historically played a significant role in maintaining the lodgepole pine cover type in a persistent seral role. Through periodic beetle outbreaks followed by regeneration periods, mixed species canopies develop and create ladder fuels. Exacerbated by events such as drought, and wind fall, large stand replacing fires will occur. However, with both its serotinous cone character and its light, small seed, lodgepole pine quickly regenerates the site. Therefore, there are persistent lodgepole pine stands maintained by the complex beetle-fire-regeneration scenario.

Man's recent fire protection has had some effect on persistent seral lodgepole pine areas. However, it is expected that even the most heroic of fire fighting efforts will only slightly delay the natural fire cycle when stands of lodgepole pine are allowed to develop to advanced ages and sizes. Persistent seral lodgepole pine thus will consistently produce a dense lodgepole pine community with a mosaic of age classes and life forms. Fires influence in the seral lodgepole pine situations must be given due regard in considering old-growth potentials in the lodgepole pine cover type.

Area of Application

The following description for old-growth applies to all areas of occurrence of persistent seral and climax species lodgepole pine in the Intermountain Region, except the Toiyabe National Forest.

Standard Summary of Old-Growth Characteristics

Vegetative Series: Douglas-fir, Engelmann spruce, Subalpine fir, Grand fir (rare)
SAF Cover Type : Lodgepole pine
Applicable Area: Intermountain Region, except Toiyabe National Forest
Site Productivity: N/A

SERAL AND CLIMAX

Live Trees

Main canopy			Variation in tree diameter	Tree decadence	Tree canopy layers
DBH*	TPA*	Age*	6-in Classes	TPA-DBH	Number
≥11	≥25	≥140	≥2	≥2-11	2

Dead Trees

Standing		Down	
DBH/ht ft	TPA	Diameter	Pieces/acre length in ft (min. length
≥11	5	≥11	≥50-≥8

Description of Attributes

Live Trees

Stands of old-growth lodgepole pine are generally characterized by an overtopping canopy of lodgepole pine in a late seral or climax situation. Some dominant trees in that canopy will exceed 13 inches DBH. However, in all stands the overtopping canopy will contain 25 or more trees per acre that exceed 11 inches DBH and are greater than 140 years of age. The total stand often contains more than 70 living trees per acre. Suppression of the stands growth from high tree density is a recognized factor that may limit the diameter of some stands. Due to competition for sun light and nutrients, some trees may reach species longevity and begin to die often without reaching 11 inches in diameter.

Horizontal and vertical structural diversity are considered to be components of old-growth lodgepole. Horizontal diversity is represented by two 6 inch diameter classes in the overall range of sizes in the stand. Vertical diversity is represented by the presence of more than one tree canopy layer. The second canopy layer is often discontinuous through the stand area. The extent of the understory canopy layer will depend on stand history. Trees may be of similar ages but are suppressed in the canopy layer. The climax lodgepole pine Forest situation usually will have 2 or more canopy levels present and distributed through the stand.

Root diseases and stem rotting fungi, insects, and wind effect especially the older trees causing broken tops or dead upper crowns. Although, randomly distributed, often in groups, two decadent trees per acre greater than 11 inch DBH should occur.

Dead trees

Standing dead trees are perhaps the most important component of old-growth. An average of at least five standing dead trees 11 inches DBH or more per acre should be present as snags. They should be randomly distributed sometimes as groups. Snags often do not last for long periods in the seral areas. An average of at least 50 pieces per acre of down dead wood greater than 8 feet in length and more than 11 inches in diameter at the small end will also occur randomly on the site. This quantity can be in one or several pieces.

Stand Size and Shape

Ten acres or more. Past inventory procedures have classified stands 10 acres or larger. Viable old-growth stand sizes and configurations have not been determined at this point. Surrounding stand conditions should be considered in determining old-growth stand size in addition to management objectives.

Some stands to be evaluated against the old-growth attributes may not be in a totally undistributed condition. Some minor tree removals may have been made in the form of salvage of immediate mortality, snag removal, or other harvest of large, valuable, individual trees. This means that some judgement must be used in evaluating old-growth conditions.

HABITAT TYPES OF OCCURRENCE

Persistent seral lodgepole pine:

Douglas-fir Climax

Pseudotsuga menziesii/Berberis repens/Berberis repens (in part)
/Calamagrostis rubescens/Pachistima myrsinites (in part)
/Osmorhiza chilensis (in part)
/Symphoricarpos albus/Symphoricarpos albus (in part)
/Vaccinium globulare/Vaccinium globulare
/Carex geyeri/Pinus ponderosa (in part)
/Carex geyeri/Carex geyeri (in part)
/Calamogrostis rubescens/Pinus ponderosa (in part)
/Spirea betulifolia/Calamogrostis rubescens (in part)

Engelmann Spruce Climax

Picea engelmannii/Vaccinium scoparium (in part)

Grand Fir Climax

Abies grandis/Calamogrostis rebescens (in part)
/Vaccinium globulare (in part)
/Linnaeu borealis/Vacinium globulare (in part)
/Vaccinium caespitosum

Subalpine Fir Climax

Abies lasiocarpa/Calamagrostis canadensis/Calamagrostis canadensis
/Linnaea borealis/Linnaea borealis
/Vaccinium globulare/Vaccinium scoparium-
/Vaccinium globulare/Pachistima myrsinites
/Vaccinium globulare/Vaccinium globulare
/Vaccinium scoparium/Calamagrostis rubescens
/Vaccinium scoparium/Pinus albicaulis
/Vaccinium scoparium/Vaccinium scoparium
/Amica latifolia (in part)
/Symphoricarpos albus
/Thalictrum occidentale
/Osmorhiza chilensis/Pachistima myrsinites (in part)
/Osmorhiza chilensis/Osmorhiza chilensis (in part)
/Spirea betulifolia
/Calamagrostis rubescens/Pachistima myrsinites (in part)
/Calamagrostis rubescens/Calamagrostis rubescens
/Vaccinium scoparium/Calamagrostis rubescens
/Berberis repens (in part)
/Pedicularis racemosa
/Amica cordifolia/Picea englemannii
/Amica cordifolia/Shepherdia canadensis
/Amica cordifolia/Astragalus miser
/Amica cordifolia/Amica cordifolia

Abies Lasiocarpa/Menziesia ferruginea
/Vaccinium caespitosum
/Xerophyllum tenax
/Luzula hitchcocki/Vaccinium scoparium
/Carex geyeri/carex geyeri (in part)
/Juniperus communis
/Amica cordifolia

Climax Lodgepole Pine

Pinus albicaulis/Vaccinium scoparium (lodgepole pine-coclimax)
/Carex rossi/Pinus contorta

Pinus contorta/Festuca idahoensis
/Arctostaphylos uva-ursi (persistent community type
/Carex rossi (persistent community type)

SAF COVER TYPE
LIMBER PINE
Code 219

Species: *Pinus flexilis* - Limber pine

Description

Where limber pine occurs in pure stand or composes the majority of the stocking it is a long lived very shade intolerant, slow growing, small to medium sized tree, predominating only on windswept, very dry environments on rocky gravels and coarse sands. The species has an affinity for sedimentary and calcareous derived soils. It occurs on low, and high altitude sites between the 40th and 45th parallels. South of the 45th it tends to shift to the upper montane and alpine treeline.

The species grows throughout the Intermountain Region on a variety of topographies, from gently rolling terrain to steep rocky slopes and cliffs. In the northern portion it is generally found at lower timberline and because of its small stature is considered an associate of the woodlands. However, it is also found on dry sites in the upper montane forest and on dry, wind-swept sites near timberline. While limber pine can and will grow in association with ponderosa pine, Douglas-fir, quaking aspen, and Great Basin bristlecone pine, its ability to survive on very dry windswept sites at various elevations allows it to predominate.

In the Intermountain Region limber pine is divided into two variants because of its occurrence and growth character. The first variant (northern) is principally a lower timberline, open forest type with an understory of shrubs or grass. The second variant (southern), which occurs mostly in Utah, is a harsh site woodlands type occupying poor soils in the upper montane forest zone to alpine timberline. The first variant is identified as "lower timberline" and the second is the "montane woodlands."

The "lower timberline" variant occurs, as described by its name in open woodlands and savannahs. Often it is a pure type, but may occur in association with Douglas-fir. These harsh sites have an open-grown character, with widely-separated clumps of trees on favorable micro-sites, separated by open grassy or shrubby areas with very few trees. The sites are often subject to much wind.

The middle and upper elevation montane woodlands are areas with moisture capability to support "montane woodlands," limber pine trees along with juniper and pinyon pine. On high elevation severe sites limber pine, whitebark pine, and Great Basin bristlecone pine occur. The trees are widely spaced, crooked, and often multi-stemmed, with sparse shrubs or herbaceous understory. The trees are often affected by strong winds on these sites. On the more favorable sites with more moisture balance, Douglas-fir may be present. Even on these sites canopies remain open; tree numbers increase only because favorable sites increase.

Most sites are relatively inaccessible and have little use by man. Most disturbances, such as fire, are very limited, as is insect and disease damage. This species, life expectancy is long as is that of its common associate, bristlecone pine. The term old-growth may have special significance on these sites as trees may live for a thousand or more years.

Area of Application

"Lower timberline" limber pine occurs primarily in the northern part of the Intermountain Region, principally in southern Idaho and western Wyoming. However, in some of this same area, some limber pine Forest also occur in the near timberline situation. This is usually where sedimentary soils are common. The overlap of this species with whitebark pine sometimes makes them difficult to distinguish. Cone characteristics are the most quickly distinguishable feature.

In most of Utah and Nevada the "montane woodlands" variant prevails. However, in a few situations a "lower timberline" stand may occur. In most cases the harsh sites are the only place that limber pine will predominate. Parent materials often control the occurrence of limber pine.

Standard Summary of Old-Growth Characteristics

Vegetative Series: Limber Pine, Bristlecone Pine, and Douglas-fir
SAF Cover Type : Limber Pine
Applicable Area: Intermountain Region
Site Productivity: Low

Live Trees

Main canopy			Variation in tree diameter	Tree decadence	Tree canopy layers
DBH*	TPA*	Age*	6-in Classes	TPA-DBH	Number
Lower timberline					
≥16	≥10	>250	≥1	Evident	≥2
Montaine woodlands					
≥16	≥10	≥500	≥1	Evidence	1

Dead Trees

Standing		Down	
DBH/ht ft	TPA	Diameter (in)	Pieces/acre length in ft (min. length)
Lower timberline			
N/A	Few	≥16	Rare
Montane woodlands			
N/A	Few	N/A	Rare

Description of Attributes

Live trees

In lower timberline: Both predominating species, Douglas-fir and limber pine, may grow to very large diameters, greater than 30 inches. However, the open grown, clumpy character of the trees keeps the total trees per acre low. In old-growth 10 or more 16-inch diameter (DBH) trees per acre are present that are older than 250 years of age. Because of the slow growth, low mortality, and windswept nature of these mature stands, standing snags are few. Relatively few, mostly random, clumps of large trees will be present. Multiple, but open canopy layers are present.

Montane woodlands: In the absence of any disturbance the two long-lived tree species occurring on the site will live to reach large diameters, often more than 30 inches. The number of trees per acre will vary greatly from stands that are very open to a more closed canopy. Ten trees per acre will be larger than 16 inches in diameter and will be 500 or more years old. Standing dead trees and down trees will be few; mortality is low.

Stand Size and Shape

Ten acres or more. Past inventory procedures have classified stands as 10 acres or larger for mapping purposes only. Minimum old-growth stand sizes have not been determined at this point.

Surrounding stand conditions and management objectives should be considered in determining stand size and configuration.

Habitat Types Where It Occurs

In central and southern Utah, the *Pinus flexilis/Pinus longaeva* series is the only recognized classification currently.

Recognized habitat types in other areas.

Pinus flexilis/Juniperus communis
/Cercocarpus ledifolius
/Festuca idahoensis
/Hesperochloa kingii
/Berberis repens

SAF COVER TYPE
INTERIOR PONDEROSA PINE
CODE 237

Species: *Pinus ponderosa* variety *ponderosa*
Pacific ponderosa pine-North Plateau Race

Description

The SAF defined interior ponderosa pine cover type encompasses a very large area of the western United States. In the Intermountain Region it occupies two distinct ecosystem situations. Pacific ponderosa pine, a broadly distributed species, has a distinct north plateau race. That race occurs east of the Cascade Mountains throughout Oregon, Washington, and into Idaho and Montana, and is the sole race discussed in this section.

This cover type has been dramatically altered by human activity. Exclusion of fire and intensive livestock grazing activities have altered stand composition. Often seral ponderosa pine stands are being replaced by associated species, such as Douglas-fir, grand fir, and occasionally lodgepole pine. In all cases, regeneration is much more abundant and has created a layered stand structure largely uncommon in presettlement conditions. Current descriptions of old-growth could be greatly contrived by man's somewhat sporadic actions. Susceptibility to catastrophic events such as fire and pathogens is dramatically changing. The capability to maintain current characteristics of developed old-growth stand attributes is not fully known or understood. However, ponderosa pine, which is a long-lived species may be slowly lost as a major cover type through successional advances, control of fire, and other human-controlled, ecosystem-altering practices.

Area of Application

In the Intermountain Region this Interior ponderosa pine north plateau race cover type occurs only on the Boise, Payette, Sawtooth, and Salmon National Forests. Within the interior ponderosa pine cover type in southwest Idaho, there are also two distinct categories of situations for old-growth ecosystem definitions:

1. Interior ponderosa pine cover type where ponderosa pine is the climax species; climax sites,

2. Interior ponderosa pine cover type where ponderosa pine is the dominant seral species; serial sites.

Refer to the "Habitat Types Where It Occurs" portion for those habitat types where ponderosa pine is the climax or seral species.

Standard Summary of Old-Growth Characteristics

Vegetative Series: Douglas-fir, grand fir
SAF Cover Type : Interior ponderosa pine
Applicable Area: Boise, Payette, Salmon, and Sawtooth NF

Live Trees

Main canopy			Variation in tree diameter	Tree decadence	Tree canopy layers
DBH*	TPA*	Age*	6-in Classes	TPA-DBH	Number
Seral sites					
24	≥10	200	≥2	N/A	2
Climax sites					
24	≥5	200	≥2	N/A	1

Dead Trees

Standing		Down	
DBH/ht ft	TPA	Diameter	Pieces/acre length in ft (min. length
Seral sites			
20/20	≤1	12	0-16
Climax sites			
N/A	Infrequent	N/A	Infrequent

Description of Attributes

Live trees

Live trees on seral sites: When a combination of 10 or more trees per acre in the overtopping canopy with a minimum diameter breast high (DBH) of 24 inches or more at an age of 200 years or older are found, old-growth characteristics are evident. These seral sites are generally the moister sites occurring on Douglas-fir and grand fir habitat type series.

Live trees on climax sites: The only difference on a climax site is that at least five trees or more per acre are present. These sites are usually on areas that do not support dense canopies of trees.

Note that in all cases the minimums are not absolute values so minor variations are acceptable.

The old-growth nature of these stands results in a variety of tree ages and sizes. Consequently, there should be at least two recognizable size classes that differ by at least 6 inches in diameter. The size difference should also create at least two layers in the tree canopy on the seral sites. The smaller diameter tree occurs within the same canopy layer on climax sites and has only one canopy layer.

Dead trees

Snags will normally be found on the climax sites, but may be clumpy and infrequent. Over large areas up to one snag per acre with a 20-inch DBH or larger, and length of at least 20 feet (average) should exist for seral sites. Insects, root and stem pathogens, and fire are the principal agents causing the development of snags in this cover type.

Climax sites generally have low or infrequent amounts of down woody material. On large area seral sites, one piece, 16 linear feet in length, at least 12 inches diameter at the small end (average) on a per acre basis should exist. This attribute is a function of site productivity, age, and the degree of decadence in the stand. Materials of smaller diameters do not normally persist long enough to be included in the old-growth conditions.

Stand Size and Shape

Ten acres or more. Past inventory procedures have classified stands 10 acres or larger. Viable old-growth stand sizes and configurations have not been determined at this point. Surrounding stand conditions and management objectives should be considered in determining old-growth stand size.

Note that some stands to be evaluated against old-growth attributes may not be in a totally undisturbed condition. Some minor tree removals may have been made in the form of selection harvest for mortality or the high-grading of valuable large trees. Judgement must be used in evaluating old-growth conditions, particularly because this cover type has generally been the first type encountered during settlement.

Habitat Types Where it Occurs

Seral sites:

*Pseudotsuga menziesii/*Agropyron spicatum* (in part)
*/*Festuca idahoensis*, *Pinus ponderosa* phase
*/*Symphoricarpos oreophilus* (in part)
*/*Carex geyeri*, *Pinus ponderosa* phase
*/*Berberis repens* (in part)
*/*Cercocarpus ledifolius* (in part)
*/*Calamagrostis rubescens*, *Pinus ponderosa* phase
*/*Osmorhiza chilensis* (in part)
*/*Spiraea betulifolia*, *Pinus ponderosa* phase
*/*Symphoricarpos albus*, *Pinus ponderosa* phase
*/*Physocarpus malvaceus*, *Pinus ponderosa* phase

Abies *grandis/*Calamgrostis rubescens*
*/*Spiraea betulifolia*
*/*Acer glabrum* (in part)
*/*Linnaea borealis*, *Linnaea borealis* phase

Climax Sites:

Pinus ponderosa/Stipa occidentalis
/Agropyron spicatum
/Festuca idahoensis
/Purshia tridentata
/Symphoricarpos oreophilus
/Symphoricarpos albus
/Physocarpus malvaceus

(* These habitat types and phases also constitute the Interior Douglas-fir cover type with ponderosa pine. "In part" refers to occurrence in part of the habitat type, usually the cold or warm extremes or the moist or dry extremes.)

SAF COVER TYPE
INTERIOR PONDEROSA PINE
CODE 237

Species: *Pinus ponderosa* variety *scopulorum*-
Rocky Mountain ponderosa pine - Rocky Mountain race

Description

This cover type has been altered by human activity. Some human encroachment through selection harvesting and cattle grazing has occurred on most lower elevation cover types. Fire prior to settlement played a dominant role in the development of these stands. However, the recent exclusion or control of fire has dramatically influenced the understory structure and composition of much of this type. Where ponderosa pine is seral, Douglas-fir and white fir are the climax vegetation species and ponderosa pine is being replaced. Large ponderosa pines remain in the overstory while the understory is dominated by the more shade tolerant species. In climax ponderosa pine areas, ponderosa pine is the overstory but a clumpy, patchy ponderosa pine understory is more common; regeneration may also be nearly absent. Such changes in stand character certainly alter the capability of maintaining or perpetuating the open, park-like stand character that existed prior to European influences. In all cases the current, denser, storied stand character is not only more susceptible to catastrophic fire, but to certain insect and disease pathogens. These mortality factors often affect whole stands rather than individual trees.

Two varieties of ponderosa pine currently are recognized. Rocky Mountain ponderosa pine, the eastern geographical variety, associated with both sides of the Continental Divide, is considered a separate variety. This Rocky Mountain variety is distinguished from the Pacific variety by the brushlike, bushy tuft (scopulate) appearance of the foliage; the Pacific variety has an plumelike foliage. This bushy tuft variety grows on the discontinuous mountains, plateaus, and canyons on both sides of the Rocky Mountains, from north-central Montana south.

Area of Application

Rocky Mountain ponderosa pine's occurrence in the Intermountain Region is limited to areas south of the northeastern portion of the Uintah Mountains near Flaming Gorge. The National Forests involved include the Ashley, Wasatch, Manti-LaSal, Fishlake, Dixie, plus the Mt. Charleston area in the Toiyabe, and the Snake Mountain Range of the Humboldt. Ponderosa pine is absent from a large portion of this area; it occurs in smaller, often discontinuous situations.

Within the Rocky Mountain ponderosa pine area of Utah and southeast Nevada there are two distinct ecosystem situations for defining old-growth:

1. Ponderosa pine cover type where Rocky Mountain ponderosa pine is the climax species; climax sites,

2. Ponderosa pine cover type where Rocky Mountain ponderosa pine is the seral species; seral sites.

Refer to "Habitat Types Where It Occurs" portion for the separation between Rocky Mountain ponderosa pine occurrence as seral or climax old-growth.

Standard Summary of Old-Growth Characteristics

Vegetative Series: White fir, Douglas-fir
SAF Cover Type: Interior ponderosa pine
Applicable Area: Utah and southeastern Nevada
Site Productivity: N/A

Live Trees

Main canopy			Variation in tree diameter	Tree decadence	Tree canopy layers
DBH*	TPA*	Age*	6-in Classes	TPA-DBH	Number
Seral sites					
20	14	≥200	≥2	≥3-5	2
Climax sites					
16	7	≥200	≥1	≥2-14	1

Dead Trees

Standing		Down	
DBH/ht ft	TPA	Diameter	Pieces/acre length in ft (min. length

Seral sites

≥15-15	2	15	2-15

Climax sites

≥14-15	1	N/A	Infrequent scattered

Description of Attributes

Live trees

On seral sites: Seral Rocky Mountain ponderosa pine sites will be moderately dense with a combination of 14 or more trees per acre in the overstory canopy, and a minimum diameter breast height (DBH) of 20 inches or more at an age of 200 years, when old-growth characteristics are evident. At 200 years many of the overstory trees will exhibit the yellow bark characteristic of over-mature ponderosa pine.

Two or more diameter classes that differ by more than 6 inches
will be present on the seral site. Two or more canopy layers will be present.
The understory will often be patchy in old-growth.

Root and stem, rotting fungi, and some insects that occur randomly in the area will control the old-growth trees with broken tops or dead upper crowns. Although random in occurrence, three trees per acre larger than 15 inches DBH average should sporadically occur to maintain this average.

Live trees on climax sites: Climax ponderosa pine will be open, with a park-like appearance. A stand will have seven or more trees per acre in the overstory canopy, a minimum 16 inches DBH, and at least 200 years of age. Ponderosa pine trees exceeding 200 years will usually exhibit the yellow bark color.

Only one tree canopy layer may be evident on climax sites, although sporadic clumps of understory seedlings and saplings may occur. Understory tree do not have to be evident. Root and stem fungi, and insect pathogens will control the number of living, decadent trees. These trees, often randomly distributed and clumped, will usually average two trees per acre with greater than 14 inches DBH.

Dead trees

On seral sites: Snags will have a grouped, random distribution, but on large areas will average two or more per acre, be 15 inches in diameter or larger, and at least 15 feet in height. Insects, root or stem pathogens, and fire are the principal agents causing the development of snags in this cover type. Down woody material is present in greater amounts where fire has been excluded. A minimum of two pieces per acre, randomly distributed, 15 inches in diameter at the small end and 15 feet in length will be present in seral communities. Down woody material will vary depending on fire frequency and past management actions.

Dead trees on climax sites: Where ponderosa pine is climax and fire has a more dominant role in stand development there will be fewer snags. One or more snags per acre that are at least 14 inches in diameter and 15 feet tall will be clumped randomly distributed over a moderately large area. Insect, root, and stem pathogens, along with fire are the principal agents causing the development of snags. Where fire is active in the climax sites down woody material will be infrequent and usually scattered. The frequency and intensity of fires on these sites will control the woody debris. The smaller sized woody debris resulting from density-related mortality does not persist long enough to be included as part of the old-growth in the climax sites.

Stand Size and Shape

Ten acres or more. Past inventory procedures have classified stands as 10 acres or larger for inventory and mapping purposes only. Minimum old-growth stand sizes have not been determined at this point. Surrounding stand conditions and management objectives should be considered in determining old-growth stand size.

Some stands to be evaluated against the old-growth attributes may not be in a totally undisturbed condition. Some harvest and other disturbances may have occurred in the past, but they do not dominate or affect the overstory canopy. Judgement must be used in evaluating old-growth conditions.

Habitat Types Where It Occurs

Seral Sites:

Abies concolor/Cercocarpus ledifolius
/Arctostaphylos patula
/Quercus gambelii
/Berberis repens
/Symphoricarpos oreophilus

Psuedotsuga menziesii/Arctostaphylos patula
/Quercus gambelii

Climax Sites:

Pinus ponderosa/Cercocarpus ledifolius
/Arctostaphylos patula
/Quercus gambelii
/Berberis repens
/Symphoricarpos oreophilus
/Muhlenbergia montana

SAF COVER TYPE
PINYON-JUNIPER
Code 239

Species: *Pinus monophylla* - Singleleaf pinyon
Juniperus osteosperma - Utah juniper

Description:

Pinyon-juniper woodlands consist of relatively few tree species, but stands exhibit considerable diversity in appearance and composition. Some stands have closed canopies with one or both species present, and little or no understory vegetation. Other stands, in contrast, are open with widely scattered junipers and/or pinyons and a wide variety of shrub and herbaceous species in a well distributed understory. Stands may consist of all ages or one age, and may have sprawling multi-stemmed or tall, single-stemmed trees.

Historically there has been a great deal of use by man in pinyon-juniper stands. This use has had a profound influence on current stand structure and character of the understory. Most of the historical and some current use has centered around grazing and mining activities. Fire suppression has also influenced stands. Most of the negative impacts on the stands have occurred within the last 150 years. Few areas were avoided because the low elevations where it occurs were usually near settlements. Because of past grazing and deforestation, for mining and heating, a great proportion of the exiting plant communities is neither climax or near climax. This cover type is, in a real sense, the result of much past human activity more than natural ecological processes.

The woodlands in the Intermountain Regions western area pinyon-juniper are either pure singleleaf pinyon, pure Utah juniper, or a combination of the two. Pinyon often is predominant in the mixed-species stands. Pure juniper stands are found only at the lowest elevations on ranges below where pinyon occurs. Juniper is generally absent from upper elevation areas of the range. These woodlands at upper elevations border the mountain brush zone. In some upper elevation areas singleleaf pinyon is mixed with curlleaf mahogany or locally with limber pine, Jeffrey pine, ponderosa pine, white fir, or Rocky Mountain juniper. Pure stands of singleleaf pinyon occur on all elevations along the western side of the Great Basin in western Nevada and eastern California. On more productive sites pinyon can grow to large size. Juniper is generally small in size and sparsely distributed on the lower drier portions of the woodlands, but larger juniper will grow on more productive sites. Junipers are also found in pure stands at all elevations across the northern Great Basin and into southern Idaho, northern Utah, and western Wyoming.

Area of Application

Pinyon-juniper woodlands in the Intermountain Region occur in two broad ecological areas. The boundary between these two areas generally coincides with the boundary between Colorado pinyon and singleleaf pinyon (Betancourt, J.L., Proceedings, 1987 pinyon-juniper conference. GTR INT-215. Ogden, Utah, USDA Forest Service page 133). Areas of hybridization between the two species are included in the Colorado pinyon region. Geographically the areas are separated by a boundary that runs through and connects the lowest elevations of the Bonneville Basin, Sevier Desert, and Escalante Desert in western Utah. The entire Toiyabe and Humboldt National Forests, the Wellsville mountains and Cache Valley portions of the Wasatch-Cache National Forest, and the Goose and Grouse Creek Mountains, Raft River Range, Black Pine Mountains, and the Cassia areas of the Sawtooth National Forest are included in this description of old-growth criteria.

For the remainder of Utah National Forests, the eastern sites influenced by Colorado pinyon and the zone of hybridization, the description and old-growth criteria developed by the Southwest Region (Region 3) are applicable.

Standard Summary of Old-Growth Characteristics

Vegetative Series: Singleleaf Pinyon - Utah Juniper
SAF Cover Type : Pinyon - Juniper
Applicable Area: Humbolt and Toiyabe NF, Sawtooth National Forest south the Snake River, the Wasatch-Cache NF portions encompassing the Wellsville Mountains and Cache Valley drainage.
Site Productivity: See description of attributes

Live Trees

Main canopy			Variation in tree diameter	Tree decadence	Tree canopy layers
1/ DRC*	TPA*	Age*	6-in Classes	TPA	Number
Low					
>12	≥12	>200	≥1	N/A	N/A
High					
>18	≥30	≥250	≥1	N/A	N/A

Dead Trees

Standing		Down	
1/ DRC/ht ft	TPA	Diameter (in)	Pieces/acre length in ft (min. length)
Low			
12-5	≥.05*	≥10	≥2-5
High			
15-8	≥1	≥12	>2-8

*Dead limbs help make up the deficit for dead material.
**Some allowance for firewood and burning activity may be allowed.
1/ Diameter root crown.

Description of Attributes:

The following attributes are the minimum acceptable criteria for threshold old-growth in the singleleaf pinyon and Utah juniper portion of the pinyon-juniper cover type.

There are two stand potential production descriptions that should be used to segregate the stand situations encountered. Low production potential stands are usually found at lower elevation, drier portions of the type. Trees are short, with diffuse, sprawling crowns, often multiple stems, and low density per acre. Juniper-dominated areas have a well developed shrub-herbaceous understory. Increased pinyon presence diminishes understory to low and sparse levels.

High production potential sites are usually the upper elevation, moister regions of the type, where trees are taller and tend to be single stemmed with less diffuse crown area. Stands are usually dense; often pinyon predominates with little understory vegetation.

Live Trees

On low production potential sites, rather open stand types have 12 trees per acre greater than 12 inches in diameter (DRC, diameter root crown), and at least 200 years of age that produce at least 8 square feet of basal area per acre average. The total canopy coverage for all live trees on this site is 15 percent or more.

On high production potential sites, total canopy coverage exceeds 35 percent for all the live trees. These largely single-stemmed stands have 30 or more trees per acre that exceed 18 inches in diameter (DRC) producing at least 30 square feet of basal area. The trees are 250 or more years of age.

Dead trees

Low production potential, open growing stands, have few standing trees that are dead. They are widely scattered with about one per 20 acres that is 12 inches in diameter (DRC) and at least 5 feet in height. Stands unaffected by firewood removals should have two pieces longer than 5 feet in length and at least 10 inches in diameter at the small end as down woody debris.

High production, denser stands have more snags per acre, with at least one 15 inches or more in diameter (DRC) and 8 feet in height per acre. The down logs on these sites occur at about two per acre greater than 8 feet in length and 12 inches in diameter.

Stand Size

Ten acres or more. Past inventories have classified stands as 10 acres or more for ease in mapping and inventory purposes only. Minimum old-growth stand size and configuration have not been determined at this point. Surrounding stand conditions and management objectives should be considered when determining stand size.

Some stands to be evaluated for old-growth attributes may not be undisturbed. Minor tree removals, grazing and other disturbances may have altered the stands. Judgement must be used in evaluating old-growth conditions.

Habitat Types Where It Occurs

Use of climax vegetation to classify sites by habitat types is unsatisfactory in the pinyon-juniper type, therefore, no classification is provided.

APPENDIX A

Forest Successional Stages

SUCCESSION: Plant communities evolve through a general series of conditions as they progress from bare ground to the final stage (climax). This gradual process is called succession and is subdivided into various stages that are known as successional stages.

1. GRASS-FORB - the vegetation is dominated by grasses and forbs. Many times remanent snags and downed logs are present in the stand. This stage is usually short-lived in most forest successions.

2. SHRUB-SEEDLING - the brush may be low brush (e.g. snowberry) or tall brush (e.g. willow) depending on the habitat type. Tree seedlings/saplings are usually under 10 feet tall. Remnant snags and downed logs may still be present in this stage.

3. POLE-SAPLING - the trees are usually taller than 10 feet, but are usually less than 8 inches in diameter. An occasional dead tree, or a few remaining snags, may be present.

4. YOUNG - trees are usually greater than 8 inches in diameter and in a vigorous stage of growth. Few snags are present and most down material is small limbs and twigs.

5. MATURE - trees have reached their height growth and their crowns start to widen, but stand conditions do not meet all the old growth characteristics. Climax (shade tolerant) tree species are becoming evident in the understory, but large snags and down woody materials are uncommon.

6. OLD-GROWTH (early phase) - has seral species as the overstory canopy (if seral species are present), with climax tree species of various sizes in an understory. Snags are starting to develop with some large down woody material present. Only occasional small openings are present.

6. OLD-GROWTH (late phase) - some describe this stage as "Stage 7." All seral species in the overstory have been replaced by climax vegetation. The understory contains various sizes of climax tree species. Usually large amounts of down woody materials are present, and most of the seral species snags have fallen to the ground. The stand may appear very patchy with many small opening containing seedlings/saplings and tall brush.

APPENDIX B

GLOSSARY OF TERMS

1. Canopy Layer - The more or less continuous cover of branches and foliage formed by the crowns of adjacent trees that is distinguishable in layers.

2. Climax - The culminating stage in plant succession for a given environment. Vegetation is assumed to have reached a highly stable condition.

3. Decadent - In a state of decline or deterioration from a normal condition. In an ecosystem, when decomposition exceeds the rate of accumulation.

4. Diameter Class - Any of the intervals into which a range of diameters, such as tree stems, may be divided for classification and use.

5. Ecological Attributes - Components of ecosystem management. The Forest Service considers six principles: diversity and sustainability, dynamics complexity and options, desired future conditions, integrated data and tools, and integrated management and research.

6. Ecological Process - The action or events that link organisms and the environment, such as: predation, mutualism, successional development, nutrient re-cycling, carbon sequestration, primary productivity, and decay.

7. Ecosystem - A community of organisms and its environment that functions as an integrated unit. Forests are ecosystems, so are ponds, rivers, rotting logs, whole mountain ranges, and the planet. They exist at various scales.

8. Fire Scar - A healing or healed over injury, caused or aggravated by fire, on a woody plant.

9. Forest Cover Type - A category of forest defined by its vegetation (particularly its composition and/or local environmental factors) that uses only on biological considerations. The classification is based on percent occupancy of an area by tree species. Tree crowns should cover 25 percent of the area.

10. Habitat Type - All land capable of producing similar plant communities at climax. It is the end result of plant succession and describes a union of overstory trees and understory plants.

11. Highgrading - Harvest of selected species or trees of economic value.

12. Krummholz - The stunted growth habit, literally crooked wood, caused by wind pruning exposed limbs above the protective snow pack.

13. Landscape - An area composed of interacting and interconnected patterns of habitats (ecosystems) that are repeated because of the geology, landforms, soils, climate, biota, and human influences throughout the area. Landscape structure is formed by patches (stand or sites), connections (corridors and linkages), and the matrix. Landscape function is based on disturbances, successional development of landscape structure, and flows of energy and nutrients through the structure of the landscape. It is composed of watersheds and smaller ecosystems.

14. Landscape Ecology - The body of knowledge pertaining to the ecological effects of spatial patterns in ecosystems.

15. Lichens - Any of a large group of moss-like plants, consisting of algae and fungi, growing in close association.

16. Lower Timberline - The lowest limit of standing tree aggregations.

17. Montane Forests - The zone of forest immediately below the subalpine, above the foothill zone, usually dominated by ponderosa pine and Douglas-fir.

18. Niche - A restricted plant or animal community controlled by micro-site variation.

19. Physiological Characteristics - Elements or characteristics that promote normal or healthy functioning.

20. Release - Freeing a tree, or group of trees, from more immediate competition by cutting or otherwise eliminating growth that is surrounding or overtopping.

21. Saprophytes - Any organism that lives on decaying organic matter, such as some fungi and bacteria.

22. Seral - A species or community that is replaced by another species or community as succession progresses.

23. Site Productivity - A measure of relative productive capacity of the vegetation of an area. May be a qualitative or quantitative term.

24. Snag - A standing dead tree or section of stem of a broken tree, from which the leaves and some of the branches have fallen.

25. Stand - A community, particularly of trees, possessing sufficient uniformity of composition, constitution, age, spatial arrangement, or condition, to distinguish it from adjacent communities.

26. Succession - Progressive changes in plant communities toward climax. May also refer to changes in a direction other than climax (see appendix A).

27. Tolerance - The performance of a species with regard to particular environmental factors such as light or moisture.

28. Topo-edaphic - Environmental influences controlled topographically and by factors relating to soil or landform.

APPENDIX C
SUB-REGION DEFINITION TEAMS

To provide some idea about what the teams' make up was and how the zones were divided, the following is provided:

Team Name:

Southwest Idaho (Boise, Challis Payette, Salmon, and Sawtooth National Forests (NFs)).

Mentor:

Chuck Wildes - Forest Supervisor - Challis NF

Technical Team:

Glenn Jacobsen, Silviculturist (Leader)
Floyd Gordon, Wildlife Biologist
Lynette Morelan, Forester
John Erickson, Wildlife Biologist
Sharon Bradley, Silviculturist
Doug Basford, Silviculturist
Dave Reeder, Wildlife Biologist
Richard Wenger, Wildlife Biologist
Roy London, Forester
Howard Hudak, Wildlife Biologist
Bob Steele, Research Ecologist
Susan Reinhard, Public Affairs Specialist

Public Members:

Roger Rosentreter, State Botanist
Dave Van De Graff, Forester (Private Industry)
Mike Medberry, Idaho Conservation League
Dave Gruenhagen, Forester State of Idaho
Dotty Douglas, Boise State University, Biology Department
Ron Mitchell, Idaho Sportsman Coalition
Bob Mosely, Idaho Fish and Game Department
Dallas Olson, Salmon International

Team Name:

Southeastern Idaho/Western Wyoming (Bridger-Teton, part of the Caribou, and Targhee NFs)

Mentor:

Brian Stout, Forest Supervisor, Bridger-Teton National Forest

Technical Team:

Doug Eggers, Silviculturist (Leader)
Bruce Padian, Silviculturist
Bill Noblitt, Wildlife Biologist
Ron Walker, Wildlife Biologist
Dee Session, Silviculturist
Hal Gibbs, Wildlife Biologist
Bob Steele, Research Ecologist

Team Name:

Northern Utah (Ashley, Uinta, part of the Caribou, and Wasatch NFs)

Mentor:

Duane Tucker, Forest Supervisor, Ashley National Forest

Technical Team:

Darrell Johnson, Silviculturist (Leader)
Sherel Goodrich, Range Ecologist
Ken Timothy, Wildlife Biologist
Chip Sibbernsen, Forester
Mary Clough, Wildlife Biologist
Dr. Dave Roberts, Professor Forestry/Ecologist - Utah State University

Public Members:

George Roether, Forestry Consultant
Dick Carter, Coordinator, Utah Wilderness Association
Ralph Miles, Utah State Division of Wildlife Resources
Dr. Dave Roberts, Professor Forestry/Ecologist - Utah State University

Team Name:

Southern Utah (Dixie, Fishlake, and Manti-LaSal NFs)

Mentor:

Hugh Thompson, Forest Supervisor, Dixie National Forest

Technical Team:

Brian Ferguson, Silviculturist (Leader)
Ron Sanden, Silviculturist
Ron Rodriquez, Wildlife Biologist
Bert Lowry, Wildlife Biologist
Bob Thompson, Range Ecologist
Brent Spencer, Silviculturist
Richard Williams, Wildlife Biologist
Mark Van Avery, Public Affairs Specialist

Public Member:

Merlin Esplin, Forester, Forest Industries
Bill Patric, Utah Wilderness Coalition
Bruce Bonebrake, Utah Division of Wildlife Resources
Dr. Kim Harper, Professor, Ecology -
Brigham Young University
Chris Goslin, Student Volunteer

Team Name:

Nevada (Humboldt and part of Toiyabe NFs)

Mentor:

John Inman, Forest Supervisor, Humboldt National Forest

Technical Team:

Gary Schaffran, Forester (Leader)
Elizabeth Bergstrom, Silviculturist and Wildlife Biologist
Steve Anderson, Wildlife Biologist
Charles Bowey, Wildlife Biologist
Robin Tausch, Research Ecologist

Team Name:

Toiyabe-Sierra (Part of Toiyabe NFs)

Mentor:

Jim Nelson, Forest Supervisor, Toiyabe National Forest
Tied in with Region 5's definition development groups.

Coordinator:

Ann Martin

Technical Team:

Roland Shaw, Silviculturist (Leader)
Elizabeth Bergstrom, Silviculturist - Wildlife Biologist
Tina Mark, Wildlife Biologist

Regional Team

Team:

Bob Cottingham, Resource Analyst (Leader)
Dr. Dave Winn, Wildlife Ecologist
Ronald C. Hamilton, Regional Geneticist
Doug Myers, Inventory Team Leader
Duane VanHooser, Forest Survey Leader